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This handbook was designed to assist economists and statisticians in the economically developing countries in initiating and conducting studies for determining future manpower requirements in relation to anticipated development. It outlines a method of estimating future manpower requirements by occupation and industry and future training requirements or high-level occupations. The method is based largely on United States experience. However, modifications of the techniques used in the United States are suggested, based on a study of forecasting techniques employed in different counties. Steps in the method are: (1) Derive a rough first approximation of the future employment structure by economic activity, (2) Make a detailed analysis of each activity, (3) Modify the first approximations of future employment in accordance with the activity analysis, (4) derive an occupational employment breakdown in each activity, in the future period, and 5) Estimate training requirements for each important occupation by analyzing the probable supply of qualified workers under existing training arrangements in comparison with estimated needs for the future period. A bibliography of materials on economic development in different countries and an international standard industrial classification of economic activities are included. (ET)

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BLS Report No. 248

THE FORECASTING OF MANPOWER REQUIREMENTS

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UNITED STATES DEPARTMENT OF LABOR
W. Willard Wirtz, Secretary

BUREAU OF LABOR STATISTICS
Ewan Clague, Commissioner

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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THE FORECASTING OF MANPOWER REQUIREMENTS

Prepared for

AGENCY FOR INTERNATIONAL DEVELOPMENT

UNITED STATES DEPARTMENT OF LABOR
W. Willard Wirtz, Secretary

BUREAU OF LABOR STATISTICS
Ewan Clague, Commissioner

April 1963

Preface

This manual is intended to serve as a guide in forecasting the manpower requirements associated with economic development. The method outlined is based largely on United States experience. However, the author has suggested modifications of the techniques used in the United States, based upon a study of forecasting techniques employed in different countries.

The manual was prepared for the Agency for International Development (AID) by Matilda R. Sugg under the supervision of Lloyd A. Prochnow in the Bureau of Labor Statistics' Division of Foreign Labor Conditions, William C. Shelton, Chief.

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The Forecasting of Manpower Requirements

Chapter 1. INTRODUCTION

The ultimate success of a program for economic and social development will depend, in large measure, on the availability of manpower possessing specific skills and training. Moreover, the training of skilled manpower must be an integral part of an overall development plan if that plan is to succeed.

This handbook* is designed to assist economists and statisticians in the economically developing countries in initiating and conducting studies for determining future manpower requirements in relation to anticipated development. It outlines a method of estimating future manpower requirements by occupation and industry and future training requirements for high-level occupations.

The following terms are used in this handbook as defined:

Manpower. Manpower is an economic resource just as material, equipment, electrical energy, and money are economic resources. Manpower in the economic sense is the managerial, scientific, engineering, technical, skilled and other personnel employed in creating, designing, developing, managing and operating productive and service enterprises and economic institutions.

Forecast. An estimate of a given variable at some future date based upon certain assumptions and economic analysis, with a large element of human judgment; used as synonymous with the term projection.

Manpower resources. The number of people available at a specific date to perform the work of the Nation; in the case of forecasts, the number expected under stated assumptions to be available at a specific future date; in other words, the supply of manpower.

Manpower requirements. The demand for manpower; the estimated numbers required at a specific date to perform the work of the Nation to implement the industrial, economic, and social development anticipated.

The Manpower Problem

Vigorous efforts are being made in many countries by leaders of government, education, industry, and labor to accelerate the rate of economic, social, and industrial development. The ultimate goal of such programs is to benefit the people of the country by raising the standards of living while at the same time preserving the basic freedoms and respecting the dignity of the individual.

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*Valuable assistance in the preparation of this manual was provided by other Bureau staff members, particularly Harold Goldstein, Chief of the Division of Manpower and Employment Statistics and Howard Rosen of that Division; and by staff members of the Division of Productivity and Technological Developments. The author also wishes to acknowledge the help of the Bureau of International Labor Affairs, the Bureau of Employment Security; the International Labour Organization; and the Agency for International Development.

The dearth of trained manpower has been a deterrent to the expansion of social services, education, and industry. Manpower shortages limit the rate of future growth in many countries. Lack of trained manpower may be more of a limiting factor to future growth than shortages of capital or natural resources.

The particular situation varies from country to country, but certain elements are common to many, such as the following:

1. A shortage of persons adequately educated in certain professional and technical occupations, particularly scientists, engineers, teachers, physicians, nurses, and other health service personnel.
2. More people educated in law and the liberal arts than the demand calls for.
3. A shortage of subprofessional workers to serve as technicians, laboratory assistants, foremen, and supervisors.
4. A shortage of administrative, executive, and managerial personnel.
5. In clerical occupations, a shortage of stenographers, bookkeepers, and skilled office machine operators, but more untrained people seeking work in the less skilled white-collar jobs than can find work.
6. A shortage of craftsmen and skilled workers such as machinists, mechanics, machine-repairmen, electricians, and plumbers.
7. A great number of unskilled and semiskilled workers in cities, creating widespread unemployment and underemployment. 1/
8. Widespread underemployment in rural areas, affecting particularly agricultural laborers and owners of small farms, caused mainly by the smallness of most farms and by seasonal fluctuations of activity.

For example the manpower problem in Pakistan is summarized in the following words:

> In summary, the key problems to be dealt with are threefold: (1) provision of high-level manpower for the critically important administrative, technical and educational work of development and nation-building, together with intermediate-level supporting occupations; (2) provision of the skilled workers, artisans, craftsmen and operatives required for industrial development; and (3) utilization of the massive reserves of underemployed and unemployed labour which constitute the greatest potential resources of the nation. 2/

1/ "Underemployment exists when persons in employment who are not working full time would be able and willing to do more work than they are actually performing, or when the income or productivity of persons in employment would be raised if they worked under improved conditions of production, or transferred to another occupation, account being taken of their occupational skills." Quoted from Resolution Concerning the Measurement of Underemployment adopted by the Ninth International Conference of Labour Statisticians (Geneva, April-May, 1957).

2/ Planning Commission, Pakistan, Development and Utilization of Manpower (Karachi, 1960), p. 2.

A Manpower Program for Economic Development

A manpower program for developing countries should be designed to formulate a manpower plan in the light of political, economic, and social objectives; to develop manpower through educating new generations and training those already in the labor force; to make proper use of existing skills and to utilize the underemployed and unemployed; to distribute manpower through guidance and assistance in job placement, with particular attention to the specially skilled and to high-priority work; to collect and analyze manpower statistics in order to identify and anticipate manpower problems; to provide special manpower services for high-level managerial, administrative, and scientific technical manpower; and to establish administrative machinery for carrying out the program.

Factual Data Desirable for Manpower Programs

Among the functions of a manpower program, none is more essential to effective planning and administration than obtaining the facts upon which to base action. 3/ If basic statistics are not available, one of the first steps must be to establish or improve existing programs for providing reliable current data. The basic statistical program and data usually required for this purpose are listed below.

Census of population. To provide a basic count of the population for the country and its geographical divisions; classified by; (a) sex and age; (b) level of education completed; and (c) occupation and industrial attachment.

Censuses of agriculture, manufacturing, mining, and commerce. To provide data on employment by industry in relation to the volume of production.

Household surveys of labor force. To provide data on the number of persons in the labor force during a specified period, classified by, (a) sex and age; (b) sex, employment status (employed, unemployed, or not in the labor force); and (c) type of worker, if employed (self-employed, employee, or unpaid family worker); (d) reason for part-time employment if not employed full time; and (e) education or special training.

3/ Harold Goldstein and Sol Swerdloff, Methods of Long-Term Projection of Requirements for and Supply of Professional, Skilled, and Other Highly Trained Manpower (prepared for the Manpower Directorate, Ministry of Home Affairs, Republic of India, 1959), Ch. VI, "Basic Manpower Statistics for Analysis of Manpower Resources and Requirements," pp. 63-104.

United Nations, Statistical Series for the Use of Less Developed Countries in Programmes of Economic and Social Development (New York, 1959), Statistical Papers Series M, No. 31.

Social security and other administrative reports. To provide data on employment in industries covered by legislative programs such as social security and factory inspection.

Establishment surveys of employment, hours, and earnings. To provide data on the number of employees in the country and in each major area, classified by type of economic activity; average weekly or hourly earnings in major economic activities; and average weekly hours in major economic activities.

A continuing program of labor market reports. To provide data on labor supply and demand in specific areas by occupation and industry.

A system of vital statistics. To provide data on births, by sex, and on deaths, by sex and age.

A reporting program by educational institutions. To provide data on enrollment at all levels, including vocational, scientific, and technical training institutions.

A reporting program on immigration and emigration. To provide information on net additions or losses to the labor force by sex, age, and occupation.

Anticipating Future Developments

The government of a developing country has an additional function. Not only must it provide facts about the current and past manpower situations, it must make an assessment of the manpower requirements of the future. In order to establish an effective program and make sound recommendations to the various participants in the manpower program, the responsible officials must provide as accurate an estimate as possible of the future manpower needs. It is of particular importance to estimate how many people will be needed in the professional, technical, and skilled occupations. Since it takes many years to educate and train people for these occupations, the need must be anticipated sufficiently far in advance to allow time for that training. Failure to anticipate the need and develop the required high level manpower may seriously impede economic progress.

The assessment of future manpower requirements must be a judgment, or a series of judgments, based upon experience and expectations of future developments. These judgments must be made without any magic formula or prophetic powers. The person making the judgments, designated here as the analyst, should have a fairly extensive knowledge of current developments in his country, and the aspirations of the people and their government. He should be thoroughly familiar with the prevailing social, political, economic, and religious patterns. He should make judgments only after consideration of the opinions of experienced observers in various sectors of the economy. He analyzes the statistics relating to all aspects of manpower and uses all the statistical techniques at his command. In the end, his evaluation of future manpower requirements is only an estimate, subject to error. But such an assessment provides a sounder basis for decision and action than any alternative evaluation.

The goal is to foresee as clearly as possible the occupational needs of the future; the industries in which people will work and the skills they will need to contribute most effectively to the country's development, while at the same time providing for themselves and their families.

The principal elements of the program of manpower studies are:

An initial assessment of current employment by industry and occupation. Realistic planning requires a knowledge of current employment: the number employed in professional, technical, administrative, and skilled occupations at the present time or in the recent past; the industries in which these people are employed; identification of the occupations in which unfilled vacancies exist; the extent of the shortage of qualified personnel. In some countries these data may be derived by special census tabulations; in other countries it may be necessary to conduct a survey of establishments. As part of such an establishment survey, employers may be asked to estimate their future requirements for skilled and specialized workers.

Estimates of future population and labor force. The rate of population growth will determine the size of the future labor force. Projections of population by age and sex should be made; the estimated rates of participation in the labor force by various age-sex groups provide an estimate of the future labor force.

Estimates of future requirements for manpower by industry and occupation. Each developing country has its own particular program for industrial development, whether or not there is an official development plan. The question to be answered is: What are the manpower implications of the anticipated development? The answer should be sought by carrying out an intensive analysis of the economy as a whole and of all important industries to determine the expected level of production and the resulting demand for personnel. Special attention should be devoted to occupations in the high-level technical and skilled categories.

An estimate of training requirements. A comparison between the anticipated demand for new entrants to each occupation requiring education and training and the estimated supply of people entering the occupation indicates the extent of the anticipated shortage or surplus. On the basis of such a comparison, training requirements can be estimated for each important occupation.

Supplementary Considerations in Forecasting

Forecasts can not predict the future with complete accuracy, no matter how carefully and intelligently they are made. But even though imperfect, forecasts will provide valuable insights into the future manpower situation and will result in information which can give meaningful guidance to policy decisions. It is important that forecasts be made without waiting for an unattainable degree of perfection in methods, data, or conclusions.

All forecasts must be continually reviewed and revised in the light of new information and unforeseen developments. A forecast which is published today may be obsolete soon after it is published. Therefore, the forecasting agency has the function of seeking new data, evaluating new occurences, and modifying the forecasts at regular and frequent intervals.

The forecasts will be of interest to many diverse groups and should be given wide distribution, both for the benefit of each group and to invite review and suggestions for improvement. An interest in the conclusions of the forecast may predispose the eventual users to be cooperative in supplying information and will focus attention on the value of collecting basic statistics in their respective fields. Users of the forecasts will include:

1. The government planning agency, to assist in the planning process.
2. The government agency responsible for stimulating and assisting industrial development, to help determine the manpower feasibility of specific projects.
3. Other government officials at national and local levels, to identify the manpower problems relating to each kind of public service.
4. Educators at all levels from primary through university, to assist in planning and administering education and training.
5. Industrialists and businessmen, to aid in long-range plans for investment, expansion, and training.
6. Labor unions and professional societies, to gain understanding of changing industrial and occupational patterns.
7. Vocational counselors, to provide the basis for advising young people.
8. Young people and their parents, to assist in making vocational choices.

Assumptions Required for Forecasts

The events of the future are dependent upon thousands of unpredictable factors; there is no way to eliminate the uncertainties. For purposes of the forecasts, however, it is necessary to make a series of assumptions regarding future national, political, and economic events. Obviously the assumptions must be made to fit the situation in each country. The following are suggestive only:

Natural events. There will be no major earthquake, famine, fire, flood, or other disaster.

Political events. There will be no major war and no internal political upheaval.

Economic conditions. There will be a continuation of the fundamental economic forces operating in the country (i.e., a continuation of economic activity which produces goods and services, and the demand for labor). There will be no major internal or international depression.

In addition to these basic assumptions, manpower forecasting requires somewhat more detailed assumptions having to do with economic activities.

Attainment of goals expressed in an official development plan. One purpose of forecasts of manpower requirements is to determine the feasibility of expansion plans. Therefore the goals of the economic development plan, if any, can become assumptions of the forecast. In other words, the forecast will answer the question, "To attain a specific goal as envisioned by the plan, how many people will be required, in which industries, and with what particular occupational characteristics?"

The goals in economic development plans may be expressed in a number of different ways:

1. Gross national product (or gross domestic product). An assumed growth rate for the economy as a whole provides a control against which forecasts can be checked to prevent an unrealistic overall estimate for the future date. The assumption of an overall growth rate implies that the conditions necessary for economic development will prevail; that capital will be available, and that the general economic environment will be favorable. If the assumed rate of increase in gross national product is greater than the rate of population growth, this implies an increase in per capita income. Increased per capita income may bring an increased demand for food, clothing, shelter, education, and health services.
2. Commodity targets. To assume attainment of targets in the plan provides an output estimate for the future date in major commodities.
3. Targets for specific services. Assuming the attainment of a specific level of education and health services as envisioned by the development plan provides a basis for estimating the number of teachers, physicians, and other related occupations required at the future date. For example, if the plan calls for a specific number of pupils in secondary schools, this can be converted into requirements for teachers.

Foreign trade. If the economy is geared to the sale of one or more major commodities in foreign markets it would be unrealistic to make any forecast without taking account of the volume of exports. It is impossible to foresee fluctuations in the demand for such products, yet it is well known that a collapse of the export market would be an economic disaster for the country. When this situation exists, it is essential to make an assumption regarding the volume of such exports. Similarly, where imports exert a major influence on the internal economy, it may be necessary to limit the uncertainties involved by assuming a given level of imports of major commodities.

Other assumptions. Specific assumptions must be made as to the size of the Armed Forces at the future date, the level of unemployment, the hours of work, and output per man-hour. These will be discussed more fully in the text as the need for such specific assumptions arises.

Illustrative Assumptions

As illustrations, general assumptions for Ceylon and the United States are reproduced below, from published documents.

Ceylon reports the following basic assumptions related to economic projections for the year 1968, the end year of the current 10-year plan:

> 1. That during the 10-year period 1959-68 there will be no serious international depression;
> 2. That Ceylon's terms of trade will on the average be equal to those of 1957;
> 3. That outside assistance in respect of skills and finance will be forthcoming in sufficient degree;
> 4. That between 1957 and 1958 population and the work force will increase by 38.2 percent and 37.8 percent, respectively. [4]
> 5. That the financial and monetary policy of the government will be geared to the implementation of the plan;
> 6. That defense commitments will impose relatively limited strain on resources;
> 7. That the determined efforts required of both the government and the people for the realization of the plan would be forthcoming. [5]

Similarly, the basic assumptions for projecting manpower needs and resources of the United States for the 1960's were spelled out as follows:

> 1. A continuation of the relatively high levels of economic activity and employment which have prevailed in the United States for the past 15 years, consistent with the goals expressed in the Employment Act of 1946. [6]
> 2. A continuation of scientific and technological advance, affecting our industrial methods of production, our medical, health, and educational services, and our consumption patterns.
> 3. The absence of war or any other cataclysmic event which would substantially alter the rate of our economic growth. [7]

Choice of a Forecast Year

The future year for which manpower resources and requirements will be forecast should be chosen with several considerations in mind:

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[4] Note the use of population and labor force projections as one of the assumptions for economic projections.

[5] United Nations, Economic and Social Council, World Economic Situation. Evaluation of Long-Term Economic Projections (New York, 23 June, 1960). E/3379/Add:3, Reply of Ceylon. p. 14.

[6] In the Employment Act of 1946, the Federal Government assumed responsibility for the creation and maintenance of conditions under which the country could achieve maximum employment and production.

[7] United States, Department of Labor, Manpower Challenge of the 1960's (Washington, 1960). p. 1.

1. If there is an official development plan, the forecast year should be the target year of the plan, since manpower requirements will be related to the targets expressed or implied in the plan.

2. The forecast year should be sufficiently far in the future, perhaps 10 years, to allow adequate lead time for the training and education of professional and technical personnel.

3. The reliability of the forecasts diminishes as the forecast year extends further into the future. Nevertheless a forecast of 15 or even 20 years may be justified to gain some insight into the problems of the long-range future.

4. Population and labor force projections are usually made for every fifth year after the most recent census of population. It is more convenient, but not essential, to forecast manpower requirements for 1 of those years. If there are good reasons for choosing other years, population and labor force estimates for intervening years can be derived by interpolation between 2 of the 5-year points.

5. Forecasts can be made for more than 1 future year if desired, for instance, 1965, 1970, and 1975. However, in this text the forecast date will be referred to as only 1 year, assuming that it will be 10 years from the base year.

Chapter II. FORECASTING MANPOWER REQUIREMENTS BY INDUSTRY AND OCCUPATION; SUMMARY AND METHOD APPLICABILITY

The forecasting of manpower requirements is more than the mere recording of statistics and the application of standard statistical techniques. Rather, it is the piecing together of relevant information and available statistical facts; the economic analysis of this body of information leading to a series of judgments regarding the rate and characteristics of economic growth; and finally the evaluation of the net effect of all these forces on manpower requirements in the future. The method presented in this manual relies heavily on economic analysis and human judgment, and uses whatever statistical techniques are available and applicable to assist in making a common sense evaluation of future needs and resources.

The method suggested here begins with the assumption that two things are available:

1. An estimate of the labor force in the forecast year. [8]
2. The structure of employment by economic activity [9] at the present time, or in the recent past, classified in whatever detail is desired in the forecast.

The end product is to be (1) an estimate of employment by economic activity and occupation [10] at a specific future date, and (2) an estimate of the number of people who should be trained for each major occupation.

The intermediate steps may be as simple or as complex as the statistical resources of the country permit. [11]

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[8] Methods of projecting population and labor force are described in a forthcoming manual (in this series) to be entitled *Demographic Techniques for Manpower Planning in Developing Countries*, by the Bureau of Employment Security.

[9] Classification by economic activity in the forecast will depend upon the classification system used in each country. For purposes of illustration, this paper will use the *International Standard Industrial Classification of All Economic Activities* (New York, 1958) United Nations, Statistical Papers, Series M, No. 4, Rev. 1. See appendix.

[10] The occupational classification used here is International Labour Office, *International Standard Classification of Occupations* (Geneva, 1958).

[11] For instance, Input-Output Analysis is an elaborate method of projecting activity levels of detailed industry sectors of an economy and translating these activity levels into employment requirements. This technique is outside the scope of this paper. For a description see:

(a) W. Duane Evans and Marvin Hoffenberg, "The Interindustry Relations Study for 1947, *The Review of Economics and Statistics*, May 1952, pp. 57-142.

(b) Conference on Research in Income and Wealth, "Input-Output Analysis: An Appraisal," *Studies in Income and Wealth*, Vol. 18 (Princeton University Press, 1955).

(c) Tibor Barna, editor, *The Structural Interdependence of the Economy; Proceedings of an international conference on input-output analysis*, Varenna, June-July 1954 (New York, Wiley, 1956).

Summary of Method

The method to be presented in this manual can be summarized in five steps. Detailed descriptions of each step are in chapters III-VII.

Step 1. Derive a rough first approximation of the future employment structure by economic activity, consistent with the anticipated increase in the labor force.

Step 2. Make a detailed analysis of each important economic activity, taking into account anticipated changes in demand for its products or services and in hours worked and productivity; thus arriving at an estimate of future employment.

Step 3. Modify the first approximations of future employment in accordance with the results of the detailed analysis of each important activity.

Step 4. Derive an occupational breakdown of employment in each economic activity in the future period by applying the best available occupational composition patterns, with particular attention to all occupations requiring specialized training or education. Sum the estimates of each occupation from the various economic activities.

Step 5. Estimate training requirements for each important occupation by analysis of the probable supply of qualified workers under existing training arrangements and facilities in comparison with the requirements as indicated by occupational estimates for the future period.

Adaptation of This Method on the Basis of the Statistics Available

The detailed, practical application of the general method outlined above will be determined in each country by the statistical data available. Although the availability of reliable, basic statistics should lead to more accurate manpower forecasts, it is recognized that a country may require such forecasts even when basic data are not available or are incomplete. The analyst will therefore face one of the following three conditions of data availability and will adapt the procedure accordingly:

Condition 1. No statistics of employment by economic activity for the overall economy are available. Employment statistics for selected industries only are available.

When statistics for the overall economy are lacking, the method presented here is only partially applicable. The forecast must be anchored to whatever statistics are available for the important industries in the country. It is recommended that an analysis be made of each industry which employs or is expected to employ in the future, persons in the occupational categories in short supply. The type of analysis to be made is described in chapter IV. The lack of adequate statistical data, and the difficulty encountered in making an analysis of this kind should not deter the analyst from proceeding in this important field of work. Available data, no matter how crude and sparse, when combined with practical judgment of those best informed, and analyzed with care and ingenuity, can provide valuable insights into the future manpower situation.

It may be particularly helpful, when statistics are lacking, to substitute the statistics from other countries. For purposes of analysis it would be possible, for instance, to make an assumption that the industrial distribution within a given sector of the economy is the same as that of another country with similar economic structure and at a similar stage of economic development, for which statistics are available; or that the economy 10 years hence will have some of the same characteristics the similar country has currently. This technique was used in a fairly recent study of Puerto Rico. 12/ It was assumed that the nonagricultural economy of Puerto Rico in 1975 would have many of the same characteristics as that of the United States in 1950. This hypothesis provided a basis for analysis.

To analysts in countries where basic statistics are inadequate, it is suggested that a study of the method outlined here may be useful; it may suggest ways in which the available data can be used; and it may focus attention more emphatically on the need for statistical data.

Condition 2. Statistics of employment by economic activity for a base year are available, but there are no historical statistics.

This condition may occur in some countries which have only recently begun the collection of statistics. The base-year distribution of employment is the point of departure in making the forecast. The future employment structure is expected to be similar in many of its characteristics to the current structure because of the expected continuity in fundamental economic forces. Therefore, it is possible to make a forecast on the basis of current statistics and estimated future changes resulting from expected operating schedules or from the economic development plan. The five-step procedure described in chapters III-VII can be followed.

Condition 3. Statistics of employment by economic activity are available for the base year and for 1 or more previous years.

Even fragmentary historical statistics give added insight into the operation of the economy. The factors which affect the demand for labor are subtle and complex; their interactions are unique to the social, political, and economic environment peculiar to each country. These factors can be expected to continue to exert their influence in somewhat the same way in the future, since they change slowly even under the impact of rapid development. Therefore it is reasonable to postulate a first approximation of the future structure of employment by extending past trends and making appropriate modifications consistent wtth foreseeable events. The procedure recommended here seeks to make maximum use of available statistics.

12/ Puerto Rico Committee on Human Resources, Puerto Rico's Manpower Needs and Supply (San Juan, 1957). 134 pp.

Chapter III. FIRST APPROXIMATION OF EMPLOYMENT BY ECONOMIC ACTIVITY IN A FUTURE YEAR (STEP 1)

Derive a rough first approximation of the future employment structure by economic activity, consistent with the anticipated increase in the labor force.

It is assumed that a labor force projection for the forecast year has been made. A first approximation of the employment in each economic activity in the forecast year can be derived by constructing a hypothetical model of the structure of that future labor force. This model is designed to serve as a framework into which can be fitted the various pieces of the more detailed analysis in the second step.

Procedure for Estimating Total Civilian Employment in the Future Year

Total labor force. Begin with the projected estimate of the total labor force in the future year.

Deduct number in the Armed Forces. Make an estimate of the number in the Armed Forces in the future year on the basis of the assumptions previously made. It is customary to assume a continuation of the base or current level of the Armed Forces unless there is some reason to believe a change will occur.

Total labor force minus Armed Forces equals civilian labor force.

Deduct the number of unemployed. There is no way for the analyst to know the actual future level of unemployment. He must, therefore, make an estimate which is consistent with his general assumptions. Sometimes the analyst uses the official target figure under a specified plan for his estimate. He may assume there is no change from the current level. Or he may assume a level equal to the average rate of unemployment in recent good years.

For example, in the Vanoni Plan of Italy, which is a program for the development of employment and income in Italy for the period 1955-64, it is estimated that, in the terminal year 1964, unemployment will fluctuate at about 3 percent a year. 13/ In the United States, when economic conditions have been good, the unemployment rate has been between 3 and 4 percent of the civilian labor force; in making its economic projections, the Bureau of Labor Statistics assumes unemployment at 4 percent in 1965, 1970, and 1975. (See table 1.)

Civilian labor force minus the unemployed equals total civilian employment. Presented in table 1 are the projections of total civilian employment for the United States which were derived by this procedure. 14/

13/ United Nations, Economic and Social Council, World Economic Situation, Evaluation of Long-Term Economic Projections (New York, 1959), E/3379/Add. 2. Reply of Italy, p. 27.

14/ Bureau of Labor Statistics, Manpower Needs and Resources of the United States: 1960-1975, Summary of Findings and Implications (Unpublished, May 1960).

Table 1. Employment and Unemployment in the United States, Actual 1957 and Projected, 1965-75

(All items in millions except percent line)

Employment status	Actual	Projections		
	1957	1965	1970	1975
Total labor force................................	70.7	79.9	87.1	94.8
Armed Forces................................	2.8	2.5	2.5	2.5
Civilian labor force................................	67.9	77.4	84.6	92.3
Unemployment as percent of labor force..........	4.3	4.0	4.0	4.0
Unemployment................................	2.9	3.1	3.4	3.7
Total civilian employment........................	65.0	74.3	81.2	88.6

Procedure for Estimating a Breakdown of Civilian Employment by Major Sector

Having derived an estimate of total civilian employment for the future year, the next step is to estimate the allocation of that total to (1) agriculture, and (2) nonagricultural economic activities.

Employment in agriculture. 15/ Generally, in the highly industrialized countries, about 15 to 30 percent of the civilian labor force is employed in agriculture. In the agricultural countries, on the other hand, about 60 to 75 percent of the labor force is so employed. 16/ It is an almost universal phenomenon that the proportion of employment in agriculture declines as industrial development proceeds, even though the absolute number in agriculture may continue to increase with expanding population.

It should be noted that total agricultural production continues to increase in developing countries even with a proportionate decline in agricultural employment. Among agricultural workers in all countries there is a great deal of underemployment. If a member of a farm family leaves the farm and takes a job in the city, there is usually no proportionate decline in the output of that farm.

To illustrate, consider the following quotation:

> In India it is thought that, with the bullocks and plows in common use, 100 acres in grain can provide employment for perhaps 15 persons 'gainfully employed' in agriculture; whereas the average number 'gainfully employed' in India per 100 acres is about 30. Allowing for the fact that some of India's agriculture is more intensive than grain, Indian

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15/ In this discussion, agriculture includes forestry, hunting, and fishing.

16/ The volume of agricultural employment cannot be adequately described by a single figure, since it changes from month to month. Therefore, in comparing various years, employment should be either an annual average, or the employment level for the same month in each year.

economists estimate conservatively that a quarter of the rural population is surplus, in the sense that its removal from the land would make no difference to agricultural output.17/

Also, as agricultural methods are improved--better seeds and fertilizers, more machinery, more scientific cultivation and irrigation--output per agricultural worker increases. This improvement in productivity makes it possible to increase production with the same number, or even fewer workers.

Table 2. United States: Gainful Workers 1/ in Agricultural Occupations, 2/ 1820 to 1930

(Workers in thousands)

Year	All workers	Agricultural occupations	
		Number of workers	Percent of all workers
1820	3/ 2,881	2,069	71.8
1830	4/ 3,932	2,772	70.5
1840	3/ 5,420	3,720	68.6
1850	3/ 7,697	4,902	63.7
1860	3/ 10,533	6,208	58.9
1870 5/	12,925	6,850	53.0
1880	17,392	8,585	49.4
1890	6/ 23,318	9,938	42.6
1900	29,073	10,912	37.5
1910	37,371	11,592	31.0
1920	42,434	11,449	27.0
1930	48,830	10,472	21.4

1/ Includes all persons 10 years of age and over who reported a gainful occupation without regard to their work or work-seeking status.

2/ Data not adjusted for relatively minor differences in agricultural and non agricultural occupations between 1820-1930 series.

3/ Figures estimated on basis of returns covering greater part of the population.

4/ Figures based on interpolation between 1820 and 1840.

5/ Includes additions due to estimated undernumeration in 13 Southern States.

6/ Excludes persons in Indian Territory and on Indian reservations, areas specially enumerated at that census, but for which areas no occupation statistics are available.

Source: U.S. Department of Commerce, Bureau of the Census: Statistical Abstract of the United States, 1959, p. 205.

17/ William Arthur Lewis, Aspects of Industrialization (Cairo, National Bank of Egypt, 1953), p. 8.

Table 3. Agricultural Employment 1/ as Percent of the Economically Active Population 2/ in Selected Countries, in Selected Years

Country	Year	Percent
Africa		
Egypt............	1937	70.7
	1947	63.8
Union of South Africa (non-European population).........	1946	52.7
	1951	37.8
America		
Brazil...........	1940	67.4
	1950	60.6
Chile.............	1940	35.6
	1952	29.6
Colombia..........	1938	72.7
	1951	53.9
Cuba..............	1943	41.5
	1953	41.5
Ecuador...........	1950	53.1
	1960	53.2
Honduras..........	1950	83.1
	1956	83.8
Jamaica...........	1943	45.1
	1953	48.8
Mexico............	1940	65.4
	1950	57.8
	1958	57.8
America--Continued		
Nicaragua..........	1940	73.1
	1950	67.7
Panama.............	1940	52.6
	1950	49.8
Venezuela..........	1941	51.2
	1950	41.3
	1955	37.9
	1959	33.9
Asia		
India..............	1941	74.6
	1951	73.9
Japan..............	1947	52.6
	1955	40.3
	1959	39.7
Malaya.............	1947	64.5
	1957	57.5
Pakistan...........	1951	76.5
	1954-56	64.7
Philippines........	1939	72.9
	1948	65.7
	1959	59.0
Thailand...........	1937	88.6
	1947	84.8
	1954	88.0

1/ Includes employers, workers on own account, salaried employees, and wage earners engaged in agriculture, forestry, hunting, and fishing.

2/ The definition of "economically active population" varies slightly from country to country. Exact definitions can be found in the source documents.

Sources: Annual Yearbook of Labour Statistics (Geneva: International Labour Office), Selected issues.

The Economic Development of Venezuela (Baltimore, The Johns Hopkins Press, 1961), p. 474.

For example, it has been established that 1 United States farm worker produced enough for himself and 3 others at home and abroad in 1820; for himself and 22 others in 1958. 18/ Over the past century and a half, a steadily declining percentage of the labor force of the United States has produced an ever-increasing supply of agricultural products.

For purposes of a forecast it is necessary to estimate the expected decline in the ratio of agricultural employment to total employment. Two approaches to the problem are suggested:

Examine past trends in agricultural employment in the country being studied if the statistics are available. It is useful to construct a time series of the ratios of agricultural employment to total civilian employment and to plot the two series on graph paper. It is possible to project these series by fitting mathematical trend lines to the historic data. But the behavior of these series in future years is likely to be influenced by the pace of the development program. Hence it is necessary to make a judgment as to whether the movement from agriculture will accelerate, continue at the same pace, or slow down in the forecast period and then extend the lines into the future, freehand. Such an estimate is likely to be superior to an estimate derived by purely mathematical trend lines.

Examine trends in agricultural employment from other countries at various stages of economic development. The relative numbers of workers engaged in agriculture vary widely among countries; similarly, the rate of change in this ratio over time varies widely, so that it is impossible to generalize from the statistics available. Nevertheless, it may be helpful to the analyst to study the statistics from other countries assembled in tables 2 and 3 which relate to the agricultural employment in various countries. Although it will be noted that in the majority of countries the percentage in agriculture declined over time, no consistent pattern emerges from those statistics to provide general guidance in making the forecast. However, as a guide to forecasting agricultural employment, the analyst may wish to utilize the experience of a country which has had development similar to that anticipated for his country. 19/

Employment in the nonagricultural sector of the economy. Having derived estimates of both total civilian employment and agricultural employment at the future date, the residual becomes the estimate of nonagricultural employment. This residual estimate is used as the basis for a further breakdown into industry divisions and industries.

Although agricultural employment is subject to a relative decline in a developing economy, nonagricultural employment is expected

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18/ U.S. Department of Labor, Bureau of Labor Statistics, Economic Forces in the USA in Facts and Figures (Washington, 1960). p. 134.

19/ For a detailed study of the movement of workers from agriculture see Why Labour Leaves the Land (Geneva, International Labour Office, 1960).

to grow as development proceeds. The various sectors, excluding agriculture, can be expected to have growth patterns definitely interrelated, stimulated by many of the same factors, affected and limited by the same influences.

If, in any country, a specific set of circumstances suggests separation at this point of another industry division, separate treatment is recommended. For example, it may be known that certain mineral resources are being depleted by current operations to such an extent that future employment in the mining division is expected to decline. In such a case it is advisable to estimate future employment in that division based upon the unique circumstances, subtract that estimate from the total, and continue the procedure with the residual total.

Procedure for Estimating Employment in Each Industry Division in Relation to Total Nonagricultural Employment

The previous action has yielded an estimate of employment in the nonagricultural sector of the economy at the future date. The next move is to estimate the distribution of that employment by industry division: Mining and quarrying; manufacturing; construction; electricity, gas, water, and sanitary services; commerce; transport, storage, and communications; and services.

Projections based on base year employment structure. The simplest procedure, to be used under Condition 2 (when no historical statistics are available), is to apply the percentage distribution of current employment by industry division to the estimate of the future total nonagricultural employment. Implicit in this procedure is the assumption that employment in every division will have the same percentage increase as total employment. Although this is obviously not realistic these proportions do have a tendency to remain relatively stable. It would be unusual if they changed drastically in a 10-year period. The analyst can render such mechanically computed estimates more reasonable by examining each division separately and introducing whatever common sense judgments seem to be indicated, on the basis of his general knowledge of developments in the country.

In a mature economy, the proportion that employment in manufacturing (or in construction or commerce, etc.) constitutes of total nonagricultural employment usually remains remarkably stable over a period of years, even when considerable growth takes place. In a developing country, however, the proportions may be expected to change somewhat, but generally the changes will be foreseeable from increased activity anticipated in particular sectors of the economy. Since the work habits and practices of the entire population are involved, the change is likely to be slow even under the impact of a vigorous program of economic development.

For example, Venezuela experienced dynamic economic growth in the decade of the 1950's with an average increase of 4 percent a year in both population and per capita income. The increase in per capita income was due primarily to the oil industry, which in 1959 constituted 20 percent of gross national product and 90 percent of the country's exports. 20/

In this dynamically changing situation, total nonagricultural employment increased more than 50 percent in the 9 years 1950 to 1959 (table 4). Employment in the petroleum industry remained almost level during that period; employment more than doubled in mining (except petroleum), 21/ construction, and electricity and water. Employment increased to some degree in all industry divisions. Yet the proportionate distribution by industry division in 1959 is not markedly different from that in 1950; there is a significant continuity in the general levels of the proportions of each division.

20/ International Bank for Reconstruction and Development, _The Economic Development of Venezuela_ (Baltimore, Johns Hopkins Press, 1961). 494 pp.

21/ In the _International Standard Industrial Classification of All Economic Activities_ the extraction of crude petroleum and oil well operations are classified in the mining industry division. In the report on Venezuela, petroleum is shown separately.

Table 4. Venezuela: Estimated Distribution of the Nonagricultural Work Force, 1950, 1955, and 1959

ACTIVITY	Employment (in thousands)			Percent			1959 index
	1950	1955	1959	1950	1955	1959	1950 = 100
Total nonagricultural employment	895.2	1,129.7	1,371.0	100.0	100.0	100.0	153.2
Mining............	5.7	9.6	11.7	0.6	0.8	0.9	205.3
Petroleum..........	42.7	42.8	43.1	4.8	3.8	3.1	100.9
Manufacturing.....	206.9	243.7	261.0	23.1	21.6	19.0	126.1
Construction......	91.1	116.2	186.8	10.2	10.3	13.6	205.0
Electricity and water...........	5.0	7.9	11.9	.6	.7	.9	238.0
Commerce..........	149.7	199.4	249.1	16.7	17.7	18.2	166.4
Transport and communications..	52.3	75.2	85.6	5.8	6.7	6.2	163.7
Services..........	341.8	434.9	521.8	38.2	38.5	38.1	152.7

Source: International Bank for Reconstruction and Development, _The Economic Development of Venezuela_ (Baltimore, Johns Hopkins Press, 1961), p. 474.

To illustrate the various procedures suggested here, it is assumed that a fictional land of Hillandale had the following structure of nonagricultural employment in 1960:

	Employment (in thousands)	Percent of total
Total	361	100.0
Mining and quarrying.......	8	2.2
Manufacturing.....	40	11.1
Construction......	26	7.2
Electricity, gas, water, and sanitary services...	11	3.0
Commerce..........	142	39.3
Transport, storage and communications.....	20	5.5
Services..........	114	31.6

An analyst in Hillandale is making a forecast for the year 1970. It has been estimated that total nonagricultural employment will increase from 361,000 in 1960 to 433,000 in 1970. He has no historical employment statistics, but must make his forecast on the basis of the 1960 statistics. He begins with the construction division. At this stage he will not make a detailed study of each component of the industry. Rather, he will postulate its growth as a whole on the basis of his general knowledge of the current economy and the changes he anticipates. He may consult with appropriate people in the government or in the construction industry to determine their expectations. He will weigh their opinions as to availability of capital, building materials, and labor, expected trends in productivity, and all factors affecting growth. The construction division in 1960 constitutes 7.2 percent of total nonagricultural employment; applying this percentage to the 1970 estimate of total nonagricultural employment (7.2 percent of 433,000), he derives an estimate of 31,200. He studies the following alternative projections:

Construction employment

	Number (in thousands)
1960.............	26
1970 (alternative projections)...	31.2
	33.8
	36.4
	39.0

	Percent of total	Index (1960=100)
1960.............	7.2	100
1970 (alternative projections)...	7.2	120
	7.8	130
	8.4	140
	9.0	150

He believes that construction employment will increase more than the general level, but the difficult question is how much more. He cannot know with any degree of certainty; he simply chooses one of the alternatives, whichever in his judgment seems most reasonable, as the first approximation.

Similarly he makes a projection for each of the other industry divisions:

Mining and quarrying;
Manufacturing;
Electricity, gas, water, and sanitary services;
Commerce;
Transport, storage, and communication; and
Services.

In table 5 a projection which could have been derived in this manner is presented as Projection No. 1. In this example it has been assumed that substantial increases will occur in manufacturing, construction, and mining; that these growing productive industries will generate growth in electricity, gas, water, and sanitary services; and in transport, storage, and communication; that two divisions, commerce and services, will show a decline in relative importance.

Projection based on base year employment structure and historical trends. Under Condition 3 (historical statistics available), it is recommended that the historical statistics be studied for their value as indicators of future economic behavior. Significant trends are usually discernible even when data are available for only a few points in time. As aids in deriving an estimate of the future employment by industry division, historical employment data may be analyzed in several ways. The following illustrations are for the fictional land of Hillandale.

Trends in number employed in each industry division. Examine the trend of employment in each industry division. Plot a time series of total nonagricultural employment and of employment in each industry division, preferably on semilogarithmic graph paper. Use the previously derived estimate of total nonagricultural employment for the forecast year to extend that line to the future date. Then, being influenced by the slope of that line, and by a judgment as to the effect of current and anticipated changes occurring in the economy, make a freehand extension of each division line to the forecast date. This is obviously a subjective operation; no two people will achieve exactly the same result. Read from the chart the estimated employment for the future year, and adjust these estimates so that they add to the projected total.

In the illustration (chart 1) it was assumed that data were available for 5 previous years; and employment in each industry division was plotted. In extending the lines for each division, more-than-general growth in the productive and supporting industry divisions was assumed; and less-than-general growth in commerce and services. The estimates so derived are shown as Projection No. 2 in table 5.

Trends in ratio of employment in each division to nonagricultural total employment. Compute the proportionate distribution of employment

Table 5. Alternative Projections to 1970: Nonagricultural Employment by Industry Division in Hillandale

(Number in thousands)

Industry division	1970			
	Base year 1960		Projection No. 1	
	Number	Percent	Number	Percent
Total nonagricultural employment................	361	100.0	5/ 433	100.0
Mining and quarrying........	8	2.2	10	2.3
Manufacturing...............	40	11.1	52	12.0
Construction................	26	7.2	34	7.8
Electricity, gas, water, and sanitary services.....	11	3.0	14	3.2
Commerce....................	142	39.3	166	38.3
Transport, storage, and communications........	20	5.5	25	5.8
Services....................	114	31.6	132	30.5

1/ Using 1960 percentage distribution modified by judgment.

2/ Using trend in number employed at 5-year intervals.

3/ Using trend in percentage of total nonagricultural employment at 5-year intervals.

4/ Using regression techniques--10 years of data.

Table 5. Alternative Projections to 1970: Nonagricultural Employment by Industry Division in Hillandale--Continued

(Number in thousands)

1970						Industry division
Projection No. 2 [2]		Projection No. 3 [3]		Projection No. 4 [4]		
Number	Percent	Number	Percent	Number	Percent	
[5] 433	100.0	[5] 433	100.0	[5] 433	100.0	Total nonagricultural employment.
10	2.3	11	2.5	10	2.3	Mining and quarrying.
55	12.7	52	12.0	49	11.3	Manufacturing.
35	8.0	35	8.0	33	7.6	Construction.
14	3.2	15	3.5	14	3.2	Electricity, gas, water, and sanitary services.
160	37.0	161	37.2	169	39.0	Commerce.
27	6.2	25	5.8	25	5.8	Transport, storage, and communications.
132	30.5	134	31.0	133	30.7	Services.

[5] Total independently projected.

Note: Because of rounding, sums of individual items do not necessarily equal totals.

Chart 1. Trends in Employment, by Industry Division

1940-60 and Projection to 1970

Hillandale

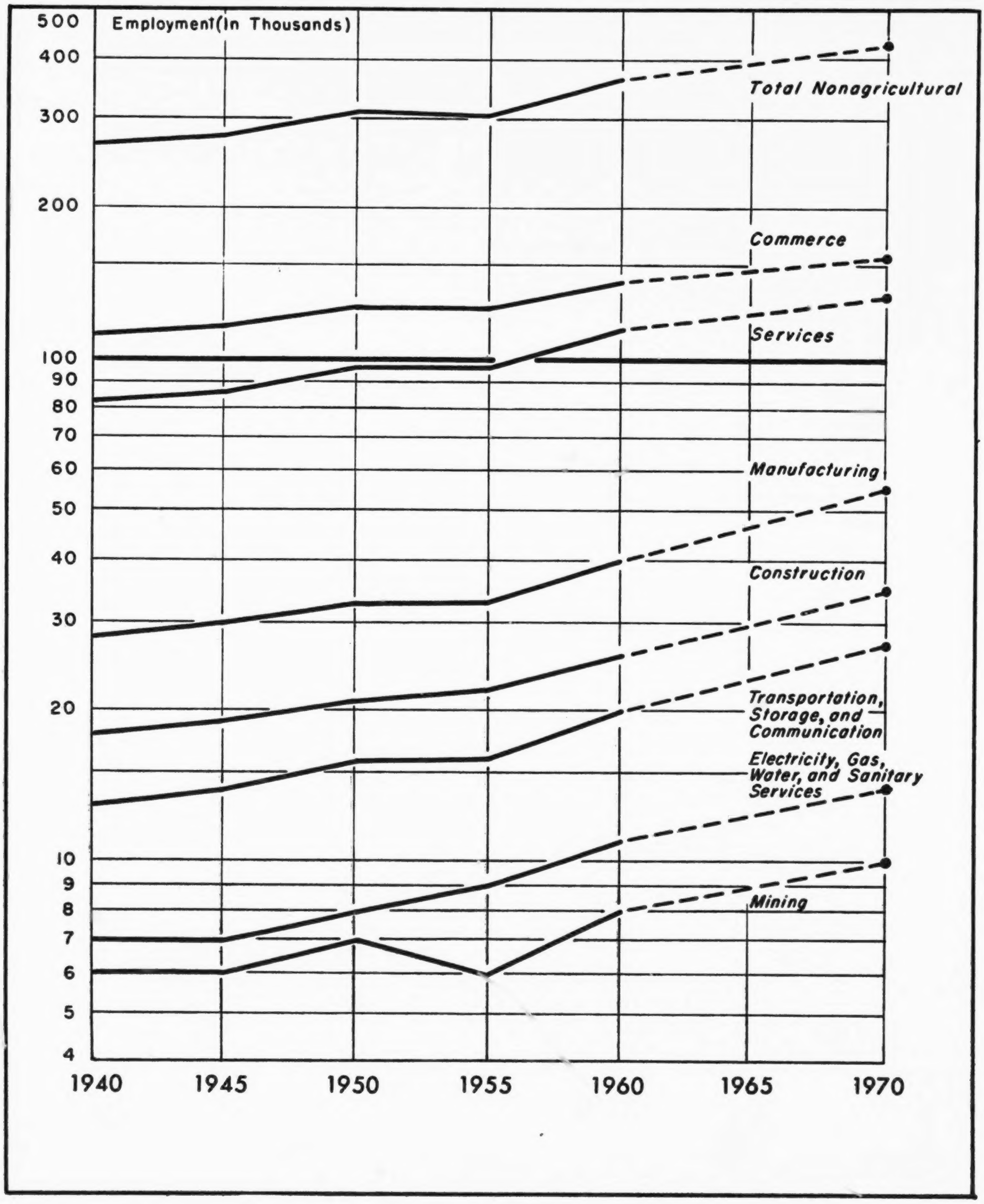
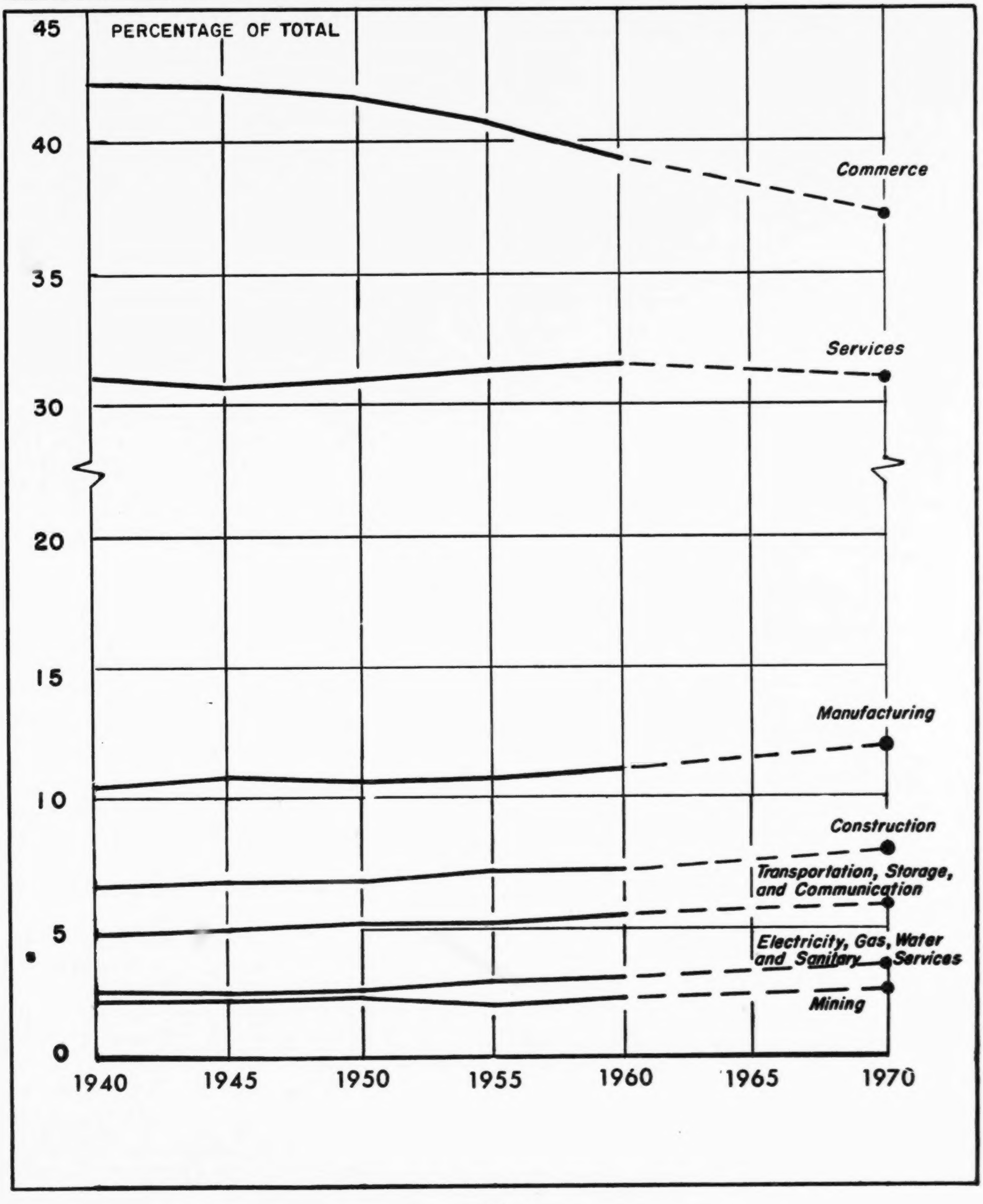


Chart 2. Trends in Percentage Distribution of Employment, by Industry Division

1940-60 Projection to 1970

Hillandale



by industry division in each year for which data are available. Plot these proportions in a time series, one line for each industry division. A freehand extension of the trend line for each industry can be made on the basis of the observed trend in the past, and the anticipated future course of activity. Once again, this is a subjective operation involving a judgment. These proportions are quite stable in a mature economy; they can be expected to move slowly in a developing economy. (See discussion of this point under Projections based on base year employment structure on page 18.)

When the lines for all industry divisions have been extended to the future year, extract from the chart the ratios of employment in each division to total nonagricultural employment and adjust them to add to 100 percent. The adjusted ratios may be applied to the projected total nonagricultural employment to provide a future estimate of employment in each division.

This procedure is illustrated in chart 2, using data for the fictional land of Hillandale for 5 previous years, resulting in the ratios and employment estimates which are shown as Projection No. 3, table 5.

Linear correlation or regression analysis. When more data are available, it is possible to estimate the future employment in each industry division by correlation analysis, 22/ that is, by reference to past correlations between nonagricultural employment and employment in each division, and by projecting this relationship into the future.

It is not surprising that there is usually a close correlation between employment in manufacturing, for example, and employment in total nonagricultural employment, since the former is one component of the latter. It is a reasonable expectation that an increase in one will be accompanied by an increase in the other. This relationship can be expressed mathematically 23/ and can be used as a tool for forecasting the level of employment in the manufacturing division to be associated with a given level of total nonagricultural employment.

For example, assume that in Hillandale the total nonagricultural employment is estimated to be 433,000 in 1970. The problem is to estimate employment in manufacturing associated with that estimate. The first step is to make a scatter diagram, showing the relationship between these two variables in the past. (Variable X = total nonagricultural employment; Variable Y = manufacturing employment. See chart 3.) Each dot represents an observation for 1 past year. Thus, in the Hillandale example, observation A represents the year 1951 when average manufacturing employment was 30,000 and average total nonagricultural employment was 290,000 (table 6). Similary a dot is placed to

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22/ In the U.S. Department of Labor's Bureau of Labor Statistics, this method is utilized only when data for 10 or more years are available.

23/ For a discussion of correlation analysis, see any standard statistical textbook. For example: Frederick J. Croxton and Dudley J. Cowden, Applied General Statistics, 2d. ed. (New York, Prentice-Hall, 1955), p. 451.

Chart 3. Scatter Diagram of Total Nonagricultural Employment and Manufacturing Employment, 1951 Through 1960

Hillandale

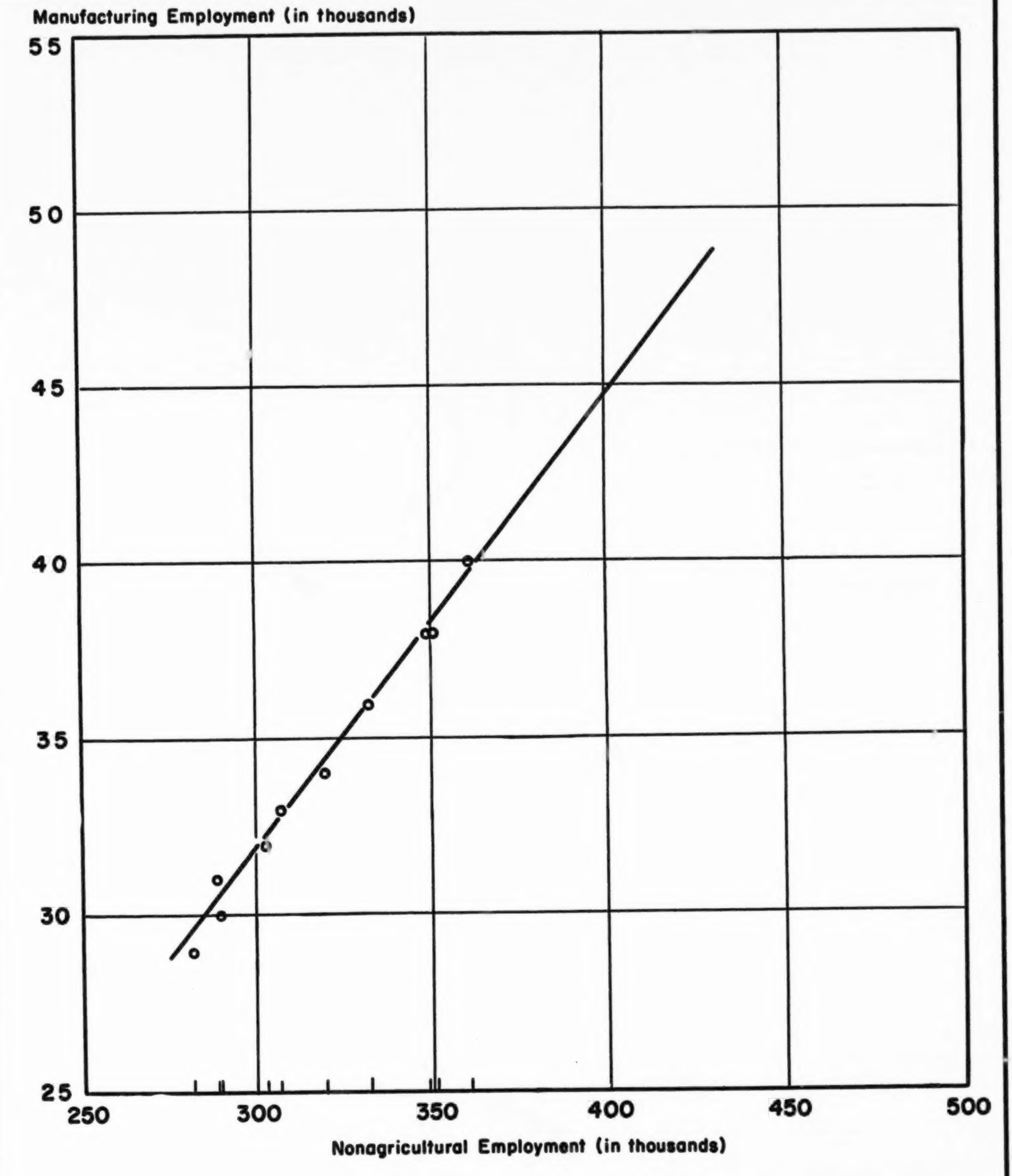

Table 6. Computation of a Line of Regression of Manufacturing Employment on Total Nonagricultural Employment in Hillandale, 1951-60

Year	Total nonagricultural employment (in thousands) X	Average manufacturing employment (in thousands) Y	X^2	XY
1951...........	290	30	84,100	8,700
1952...........	283	29	80,089	8,207
1953...........	289	31	83,521	8,959
1954...........	303	32	91,809	9,696
1955...........	307	33	94,249	10,131
1956...........	320	34	102,400	10,880
1957...........	333	36	110,889	11,988
1958...........	349	38	121,801	13,262
1959...........	351	38	123,201	13,338
1960...........	361	40	130,321	14,440
Total..........	3,186 $=\Sigma X$	341 $=\Sigma Y$	1,022,380 $=\Sigma X^2$	109,601 $=\Sigma XY$

Formula $\Sigma Y = Na + b\Sigma X$

$\Sigma XY = a\Sigma X + b\Sigma X^2$

$341 = 10a + 3{,}186b$

$109{,}601 = 3{,}186a + 1{,}022{,}380b$

$108{,}643 = 3{,}186a + 1{,}015{,}060b$

$109{,}601 = 3{,}186a + 1{,}022{,}380b$

$958 = 7{,}320b$

$b = .131$

$341 = 10a + 417$

$-76 = 10a$

$a = -7.6$

$Y = a + bX$

$Y = -7.6 + .131X$

If $X = 433$

Then

$Y = -7.6 + 56.7$

$Y = 49.1$

represent each observation. If the correlation between the two series is high, the dots will lie more or less along a straight line. If they scatter widely the correlation is low, and this method is not applicable.

The relationship between the two variables is expressed by the equation $Y = a + bX$. A line can be fitted to the scatter diagram by use of the following normal equations:

I. $\Sigma Y = Na + b\Sigma X$

II. $\Sigma XY = a\Sigma X + b\Sigma X^2$

Table 6 shows the computations that are necessary to determine the values to be substituted in these equations. The substitution yields as follows:

$$\begin{array}{lrcl} \text{I.} & 341 & = & 10a + 3{,}186b \\ \text{II.} & 109{,}601 & = & 3{,}186a + 1{,}022{,}380b \end{array}$$

Multiplication of all items in Equation I by 318.6 permits the cancellation of "a" by subtracting Equation I from Equation II. Thus:

$$\begin{array}{lrcl} \text{II.} & 109{,}601 & = & 3{,}186a + 1{,}022{,}380b \\ (\text{I} \times 318.6) & 108{,}643 & = & 3{,}186a + 1{,}015{,}060b \\ \hline & 958 & = & 7{,}320b \\ & b & = & .131 \end{array}$$

Substituting in Equation I, the new found value of "b," the value of "a" is found.

$$\begin{array}{lrcl} \text{I.} & 341 & = & 10a + 417 \\ & a & = & -7.6 \end{array}$$

The equation of the line is:

$$\begin{array}{rcl} Y & = & a + bX \\ Y & = & -7.6 + .131X \end{array}$$

Now the previously estimated value of X (total nonagricultural employment) for the year 1970 in Hillandale (433,000 in 1970) can be substituted in this equation:

$$\begin{array}{rcl} Y & = & -7.6 + 56.7 \\ Y & = & 49. \end{array}$$

Thus, manufacturing employment in 1970 is estimated to be 49,000 if total nonagricultural employment is 433,000.

A series of seven regression analyses will produce estimates of employment in the seven divisions associated with the projected total nonagricultural employment. The total of the seven divisions will equal the projected total.

This procedure has a number of advantages. It allows for internal shifts in the economy and provides a projection which takes into account the interaction between divisions in the past. It is a more objective method than those previously described and does not depend upon the exercise of human judgment; different people using this procedure will reach the same answer. There are also disadvantages to the procedure:

It requires historical data.

In countries in which employment levels for the forecast period are expected to be higher than ever experienced, it is necessary to project well beyond the past relationship. This is always risky; the nature of the relationships between industries could change at significantly higher levels of activity.

This method assumes that the factors affecting employment in the various divisions in the past, and the interrelationship among them, will continue to operate with the same impact in the future. Actually, it may be known that certain dynamic changes are likely to affect future employment in specific activities in a manner significantly different from past experience. The analyst may therefore find it necessary to modify the estimates on a judgment basis. For example, he may know of a technological innovation in a given industry that is expected to change output per man-hour significantly, thus affecting employment trends in a way that is not anticipated in the past trends of the industry.

In the illustration, the estimates have been computed for Hillandale on the basis of historical statistics for the 10 years, 1951-60. The estimates so derived are presented as Projection No. 4 in table 5.

Procedure for Estimating Employment in Each Industry in Relation to Employment in the Divisions

Depending upon the level of detail in the basic data, the procedures described above may be used to relate each industry to its division total, yielding a breakdown of employment in each industry division in the future period. For example, the manufacturing division will be broken down into major groups as follows: Food manufacturing (except beverages); beverage industries; tobacco; and other groups. Likewise, the other industry divisions will be broken down into component parts.

This procedure permits orderly development of consistent, detailed projections which constitute a first approximation of the future employment in each industry or economic activity.

Chapter IV. DETAILED ANALYSIS OF EACH IMPORTANT ACTIVITY (STEP 2)

Make a detailed analysis of each important economic activity, taking into account anticipated changes in the demand for its products or services and anticipated changes in hours worked and productivity, arriving at an estimate of the future employment.

Preface to Analysis

The projections of employment yielded by the foregoing procedure may be considered as somewhat crude first approximations. The next step is another way of making employment estimates for the future. This step consists of examining each economic activity and applying as much analytical skill and common sense judgment as possible to an evaluation of future expectations. This must be a painstaking analysis of factors affecting demand for workers in each industry, an assessment of how these factors may operate in the future, and a modification of the projected employment levels based on judgment. Ideally, if sufficient personnel and unlimited time were available, an analysis could be made of each minute activity. In practice, it is necessary to concentrate on certain strategic industries, accepting the first approximation of employment for others regardless of their imperfections.

The analysis of each economic activity will depend largely upon the skill and ingenuity of the analyst, and the extent to which he is able to utilize whatever data are available. [24]

Selecting Economic Activities for Detailed Analysis

In developing countries there are usually two distinct sectors of the economy: the traditional and the modern.

> The traditional sector comprises mainly peasant agriculture, handicrafts and small-scale industry, and the financial, transport, distribution and other services associated with these activities. It is roughly coterminous with the rural village economy, although traditional handicrafts may appear in cities as well. It is characterized by high ratios of labour to capital and often also to land; by relatively slow technological progress; by little or no capital accumulation; and by low productivity per man-year. The typical form of productive organisation is the household. The modern

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[24] For examples of economic analyses of various sectors of developing economies see the series of studies prepared by the secretariat of the United Nations Economic Commission for Latin America: Analyses and Projections of Economic Development: I. An Introduction to the Technique of Programming; II. The Economic Development of Brazil; III. The Economic Development of Colombia; IV. The Economic Development of Bolivia; V. The Economic Development of Argentina; VI. The Economic Development of Peru; VII. The Economic Development of Panama.

sector, on the other hand, is composed of plantation or other large-scale commercial agriculture, milling, petroleum and refining, large-scale manufacturing, and the financial, transport, distribution, personal and other services associated with these activities. As a contrast to the traditional sector, the modern sector is characterized by high captial-labour ratios; by capital accumulation; by technological progress; by relatively high productivity per man-hour; and by provision of wage-earning employment.

All too often, these two sectors conform to leading and lagging regions. In Italy, for example, the modern sector is roughly coterminous with the north and the traditional sector with the south. The same is true of Mexico. In Brazil, the modern sector has developed mostly in the south, especially in the Rio and São Paulo areas, while the traditional sector predominates in the north and northeast. In Indonesia, most of the people in the traditional sector live in Javanese villages while the plantations, oil fields and refineries, and mines of the modern sector are found mainly in the Outer Islands. Between the leading and lagging regions within a country the differences in income levels are often striking. For instance, in Italy, income per head in the south in 1959 was 46.6 percent of that in the north and, in Brazil, income per head in the Northern region and in the northeastern region in 1958 were, respectively, 43 percent, and 27 percent of that of the more dynamic southern region. 25/

The detailed analysis recommended here will be confined to industries of the modern sector. The primary criterion in choosing industries for detailed analysis is the industry's likelihood of requiring, in the future, substantial numbers of persons with high level skills and education. The second criterion is accessibility of data required for the analysis.

Industries to be analyzed will be chosen from the following groups of activities:

Activities for which new construction is underway or specifically scheduled. It is likely that the construction of some new factories, dams, airports, or other facilities has been started and that other construction is in the planning stage. Information about such plans may be obtained through any existing planning agency of the government, from the offices which issue building permits, from employer associations, finance agencies, or from other sources. Officials in the expanding industries may have valuable information regarding the anticipated future production and manpower requirements. Such information should be sought through interviews with the appropriate people in these industries.

25/ Employment Objectives in Economic Development. Report of a meeting of Experts (Geneva, International Labour Office, 1961), p. 27.

For example, in the Republic of Ghana an immense hydroelectric project is being constructed on the Volta River. 26/ The project will back up the river waters to form one of the largest manmade lakes in the world. Power will be provided for working the vast bauxite mines in the country, and for a large aluminum smelter. There will be sufficient power to attract other industries and to electrify the southern third of the country's area. In addition, the new lake will provide transportation to the country's northern area and is expected to encourage a fresh water fishing industry.

A manpower survey conducted in Ghana in 1960 included projections of manpower requirements up to July 1965, and in doing so, gave special consideration to the Volta River Project.

> Because the Volta project will have such a great impact on the economy, explicit assumptions have been made with regard to it; namely that it will be undertaken in the period 1960-66, generally in accordance with plans submitted by Kaiser Engineers. Thus the labour requirements for the dam, the generating plant, the transmission lines and the town, have been included in this Survey, while those for the aluminium smelter have not. 27/

Activities for which specific targets have been established in an economic development plan. Comprehensive economic development plans in some countries have set specific production goals at a given time for segments of the economy. One of the tasks of this analysis is to examine the feasibility of these targets in terms of the manpower required for their accomplishment. Hence, it is reasonable to start with the assumption that the stated goals will in fact be reached. The problem then is to estimate the manpower requirements consistent with the goals.

The goals are usually stated in physical terms, such as the number of tons of cement, or yards of cotton textiles; or in terms of a service to be performed, such as the education of a given number of students at various levels.

The commodities and services listed in the economic development plan will be variously related to the industry classification system being used and, for the purpose of the analysis, will need to be fitted into the classification scheme.

Some commodities in the economic development plan will represent the total output of one of the industries of the system.

Examples:
Coal mining (ISIC Code 110)
Sugar refineries (ISIC Code 207)
Manufacture of Cement (ISIC Code 334)

26/ Ibid., p. 162.

27/ *Survey of High-Level Manpower in Ghana 1960* (Accra, Ghana, Ministry of Information, 1961), p. 10.

Some commodities will represent only partial output of one of the industries of the system.

Examples:

Sewing machines (part of the output of ISIC Code 360: Manufacture of machinery; except electricial machinery)

Cotton textiles, number of yards (part of the output of ISIC Code 231: Spinning, weaving, and finishing textiles). This Code includes all types of textile fibers, cotton, wool, and synthetic fibers.

Some targets of the plan will cut across industry lines, requiring a determination of the effect on different industries.

Example: Education

If the target is expressed in terms of the number of schools to be built and the number of students to be educated, the analysis must take account of the effect on the construction industry (ISIC Major Group 40), and education services, (Group 821).

Activities whose production and manpower requirements can be related to population growth. One of the goals of the industrialization process in all countries is to increase the standards of living of the people. It is difficult to assess the future effective demand for consumer goods because this in turn depends upon the effectiveness of the development program and the extent to which the benefits from economic gains will be distributed among the population. But it may be reasonable to make an assumption that somewhat better nutrition, shelter, and clothing for the population will be forthcoming and that there will be an improvement in education and medical care. A forecast can be postulated then, estimating future output of the basic necessities of life consistent with such an assumption.

A number of industries can be studied in relation to population growth, as shown below by ISIC major group:

Food and beverages:
- 20 - Food manufacturing industries, except beverage industries
- 21 - Beverage industries
- 22 - Tobacco

Clothing and footwear:
- 23 - Manufacture of textiles
- 24 - Manufacture of footwear, other wearing apparel, and made-up textile goods

Shelter:
- 40 - Construction
- 26 - Manufacture of furniture and fixtures

Education and medical care:
- 82 - Community services
  - 821 - Education services
  - 822 - Medical and other health services

Electricity, gas, water, and sanitary services
- 51 - Electricity, gas, and steam
- 52 - Water and sanitary services

Activities for whose products and services additional demand will be generated by the above. In order that estimates of the future employment structure will be internally consistent, it is necessary to consider industries which will be affected by the demand generated by the activities previously mentioned. For example, if it has been assumed that a particular manufacturing industry will expand in the future, allowance must be made for a corresponding increase in: the construction of plants, the manufacture of raw materials and packaging; light, power, water, and sanitary services; transportation of raw materials, finished products, and workers to and from plants; housing for workers; and communication services.

Information Desired for Analysis of Each Economic Activity

The analysts in each country face to some degree a scarcity of basic data for an analysis of this kind. The nature of the analysis will be limited by the quantity and quality of information that can be assembled. Their aim must be to do the best job permitted by the circumstances.

A wealth of information and insight into problems can be obtained through personal interviews with well informed people in industry, government, trade associations, and labor unions. Since the analysis is based to a large extent on judgment, the opinions of those people most closely associated with each industry should be sought and weighed in reaching conclusions for purposes of the forecast. Such people will often be able to guide the analyst to valuable sources of information; they may have unpublished statistics of great value; they will certainly have a general knowledge of the industry and can provide answers to many questions.

To the extent that statistics and other information are available, the following information for each activity to be analyzed should be assembled:

A description of the economic activity, as currently constituted; use current or base year statistics. The industry should be identified, in terms of the industrial classification system being used, with an exact definition; geographic location; general description of the physical properties, such as factories, mines, or shops; commodities produced or services rendered; description of major products or services; current volume of output in physical units and/or in money value; nature of the operations performed: Manufacturing process, sales, construction, etc.; total number employed in the industry, by sex; occupational breakdown of employment; levels of earnings, by occupation, hours worked, and supplementary benefits; number of establishments; number employed by establishment, maximum, minimum, and average employment; capital requirements per employee, and per unit of output; types and condition of equipment, such as machine tools, industrial equipment, trucks, and railroad cars; extent of technological progress, whether modern efficient production, or obsolete traditional methods; raw materials used and sources of supply; and practices with regard to labor-management relations.

Historical background, descriptive and statistical; trends in employment, hours, and earnings; trends in production; trends in output per worker; technological progress in the past; occupational trends; and trends in exports.

Nature of the demand for the product or service. Industrial consumers. Is the product used in further manufacture, therefore dependent upon the level of other industries? Individual consumers. What are their characteristics as to age, income level, occupation, and education? Circumstances influencing demand for the product or service. Seasonal? Cyclical? Related to urban or rural living? To social or cultural factors? Competitive position with regard to--imports; and other domestic industries; Value of exports.

Factors which may affect future growth or decline of industry. Future production goals; economic development or other government plans; availability of capital; anticipated changes in all demand factors under Nature of the demand for the product or service above; limitations on raw materials; prospects for technological advancements and resulting increase in output per man-hour; anticipated changes in hours of work; anticipated population growth.

Collection of Data, Suggested Sources of Published Data

Government publications:

- Censuses, such as population, trade, agriculture, and manufacturers.
- Labor statistics bulletins;
  - Labor force, employment, unemployment, hours of work, earnings, etc.
- General statistical publications:
  - National income, foreign trade, and financial statistics.

Statistical publications of international agencies:

- Inter American Statistical Institute.
- United Nations and its specialized agencies:
  - Economic Commission for Europe
  - Economic Commission for Latin America.
  - Economic Commission for Asia and the Far East.
  - Economic Commission for Africa.
  - International Labour Organisation.
  - International Bank for Reconstruction and Development.
  - World Health Organisation.
  - Food and Agriculture Organisation.

Trade journals, directories, publications.

Financial and other reports of industries.

Daily newspapers.

News magazines.

Publications of trade associations, labor unions, chambers of commerce and professional societies.

Many publications from these and other sources are included in the bibliography at the end of this manual.

Preparing the Analytical Document for Each Economic Activity to be Analyzed

The analysis of each industry or activity can be carried out by preparing a paper, an instrument to guide the analyst toward a sound judgment with regard to the future employment level in the industry. The analytical document has two parts as described below:

Part I. Arriving at judgments on three elements: (a) The level of production of the industry at the forecast date; (b) The level of productivity (output per man-hour) at the forecast date; (c) The hours of work at the forecast date.

Part II. Utilizing these judgments to derive the estimated employment level at the forecast date.

Part I. The judgments. Utilizing all the information assembled for the industry, the analyst studies, sifts, and weighs the various factors which he expects will influence the industry. In the analytical document, he enumerates the factors which he considers significant and explains the basis upon which he reaches each conclusion.

(a) The level of production of the industry at the forecast date. (1) Planned segments of the economy. If there is an official economic development plan, the analyst accepts the targets of the plan as his estimate of future production, relating the commodities mentioned in the plan to the industries as classified for the forecast.

Even when there is no development plan, certain segments of the economy may be planned for several years ahead by the government or some central body. For instance, in nearly all countries, highway construction is scheduled several years in advance. Such advance plans may be utilized as estimates of future production for these segments. (2) Unplanned segments of the economy. Future production in industries with no planning must be estimated by taking into consideration all the factors expected to influence production; principally, the nature of the demand for the product and the expected volume of that demand at the forecast date, as they may be influenced by the level of GNP and consumer expenditures; the level of imports and exports; the availability of capital, raw materials and labor.

One of the problems in this procedure is obtaining measures of the physical output of the various industries. For a limited number of industries, the output is a single commodity; production volume may be stated in physical units of the product, such as tons of coal or tons of cement.

If an industry makes many different products it is impossible to sum the units of different products, such as radios and refrigerators of various styles and complexities. In such multiproduct industries, it is customary to express production volume in either of two ways (a) monetary value, or (b) as an index of physical production.

(b) Productivity changes. Productivity must be considered as a key determinant of the future level of employment. Productivity is defined as output per man-hour, or

$$\frac{\text{Production (total number of things produced)}}{\text{Man-hours (total number of man-hours worked in that production)}}$$

In considering a particular industry, the analyst must estimate the change in productivity during the forecast period. For instance, assume that the output of an industry is expected to double in 10 years. The question is "How much will employment increase in order to produce twice as much?" At one extreme there is the possibility of doubling employment--assuming constant productivity and constant average hours of work per worker. At the other extreme, there is the possibility of no increase in employment or hours worked, but doubling production by doubling output per man-hour.

Usually the situation will lie between these two extremes. The judgment as to the anticipated effect of productivity changes must be made on a basis of some knowledge of the industry being studied, and some assumptions regarding the factors likely to affect productivity.

It is risky to generalize about productivity. Studies of productivity in the United States have established the fact that changes in productivity are not consistent or automatic, but that there is a wide range (from substantial declines in output per man-hour to substantial increases) in the productivity change from time to time in the same plant; from plant to plant in the same industry; from industry to industry in the same division, such as manufacturing; and from sector to sector in the United States economy. There is reason to expect similar disparities in the productivity experience of other countries.

Nevertheless, in overall terms, it is logical to expect productivity to increase in the economy as a whole and in all industries in the modern sector of a country where economic development is proceeding. The factors which affect productivity in any industry in any country are numerous, complex, and often unmeasurable. But, in summary, the factors which may be expected to increase productivity in a manufacturing industry in the modern sector of a developing country include:

1. Scientific and technical factors: (a) more and better tools, equipment, and machines; (b) more electric or mechanical energy applied to production; (c) new production methods; and (d) better materials.

2. Management factors: (a) more skilled organization and management of plant; (b) better scheduling of work; more efficient plant layout and division of labor; (c) more efficient use of materials and components; (d) better personnel policy to reduce labor turnover; and (e) better labor-management relations.

3. Labor factors: (a) better general health of workers; (b) increasing skill levels; (c) better general education; (d) better distribution of staff in order to

utilize their skills more effectively; and (e) better labor-management relations.

4. Economic factors: (a) increased flow of capital investment; (b) increased rates of operations, based on greater demand for product; and (c) shifts in preponderance of production to plants with higher productivity.

The analyst will be guided in making a judgment regarding anticipated productivity change by whatever statistics are available on past trends or current levels of output per man-hour. If productivity levels are known for one or more advanced plants in the industry, they may be used as a general guide to the potentials of the industry.

(c) Hours of work: The length of the workweek and of the workyear will have a significant influence on manpower requirements of the future. Therefore, some judgment must be made as to whether the total hours worked per worker will remain the same in the forecast year as in the current year, or will change. In the United States, there has been a steady decline in the number of hours worked in the past 50 years. Formerly, a 72-hour workweek was standard in many industries; today, the 40-hour workweek is usual. Furthermore, paid vacations and holidays are much more prevalent today than in former years.

In developing countries, an opposite trend may be taking place as underemployment is eliminated and as a higher proportion of workers work fulltime.

Part II. Utilizing these judgments to derive the estimated employment level at the forecast date.

(a) The basic concept of productivity. In this section, the following basic expressions of the productivity relationship will be used.

Productivity is defined as:

$$\frac{\text{Production (total number of things produced)}}{\text{Man-hours (total number of man-hours worked in that production)}} = \text{Output per man-hour}$$

It follows then that:

$$\frac{\text{Production}}{\text{Output per man-hour}} = \text{Man-hours}$$

and

$$\frac{\text{Total man-hours}}{\text{Man-hours per worker}} = \text{Number of workers}$$

(b) Computing the estimate of future employment. The analyst can now estimate the effect of the anticipated changes on the level of employment. In practice, this procedure is complicated, difficult, and hazardous because of the uncertainties involved. In concept, it is clear cut, and can be explained by the use of several simplified illustrations:

Example 1. Industry A

1960 basic data:

Total annual production....................	4,000,000 units of product
Average employment during the year.........	1,000
Weeks worked per year......................	50
Average hours per week per worker..........	40
Total hours per worker per year............	40 x 50 = 2,000
Total man-hours per year...................	2,000 x 1,000 = 2,000,000

Output per man-hour (productivity):

$$\frac{\text{Production}}{\text{Man-hours}} \qquad \frac{4,000,000}{2,000,000} = 2 \text{ units of product per man-hour}$$

The judgments for Industry A.

(a) Annual production in 1970 will be 20 percent above 1960, or 4,800,000 units of product.

(b) Output per man-hour in 1970 will be 10 percent above 1960, or 2.2 units of product per man-hour.

(c) Hours of work will decline 10 percent by 1970, to 36 hours per week, 50 weeks of the year, or 1,800 hours per worker per year.

Thus the computation of the estimate of employment is as follows:

Industry A - 1970

$$\frac{\text{Production}}{\text{Output per man-hour}} = \text{Man-hours} \qquad \frac{\text{Man-hours}}{\text{Manhours per worker}} = \text{Workers}$$

$$\frac{4,800,000}{2.2} = 2,181,818 \qquad \frac{2,181,818}{1,800} = 1,212$$

Conclusion: The estimated employment level of Industry A in 1970 is 1,212.

Example 2. Industry B

A multiproduct industry. Monetary value is used as a measure of production.

1960 basic data: Total annual production

Product	Units	Unit value	Value of production
A...............	400,000	$4	$1,600,000
B...............	100,000	2	200,000
C...............	50,000	8	400,000
			$2,200,000

Average employment during the year	1,000
Weeks worked per year	50
Average weekly hours per worker	44
Total annual hours per worker	44 x 50 = 2,200
Total annual man-hours	2,200 x 1,000 = 2,200,000

Output per man-hour (productivity):

$$\frac{\text{Production}}{\text{Man-hours}} \qquad \frac{2{,}200{,}000}{2{,}200{,}000} = \$1 \text{ per man-hour}$$

The judgments for Industry B.
(a) Annual production in 1970 will be above that of 1960 as indicated:

Product	Percent change 1960-70	Units	Unit value (constant dollars assumed)	Value of production
A	+25	500,000	$4	$2,000,000
B	+50	150,000	2	300,000
C	+10	55,000	8	440,000
				$2,740,000

(b) Output per man-hour in 1970 will be 15 percent above 1960, or $1.15 per man-hour.

(c) Hours of work will be the same in 1970 as in 1960: 44 hours per week, 50 weeks of the year, or 2,200 hours per worker per year.

The computation of the estimate of employment:

Industry B - 1970

$$\frac{\text{Production}}{\text{Output per man-hour}} = \text{Man-hours}$$

$$\frac{2{,}740{,}000}{1.15} = 2{,}382{,}609$$

$$\frac{\text{Man-hours}}{\text{Man-hours per worker}} = \text{Number of workers}$$

$$\frac{2{,}382{,}609}{2{,}200} = 1{,}083$$

Conclusion: The estimated employment level of Industry B in 1970 is 1,083.

Example 3. Industry C

A multiproduct industry. Index numbers are used to represent production, man-hours, and productivity.

1960 basic data:

Total annual production = 100 (Production index)

Average employment during the year..........	1,000
Weeks worked per year......................	50
Average weekly hours per worker............	40
Total annual hours per worker..............	40 x 50 = 2,000
Total annual man-hours.....................	2,000 x 1,000 = 2,000,000

By definition total man-hours in 1960 = 100 (Man-hours index)

Output per man-hour (productivity):

$$\frac{\text{Production}}{\text{Man-hours}} \qquad \frac{100}{100} \times 100 = 100 \text{ (Productivity index)}$$

The judgments for Industry C.

(a) Annual production in 1970 will be 20 percent above 1960: Index = 120.

(b) Output per man-hour in 1970 will be 10 percent above 1960: Index = 110.

(c) Hours of work will decline 10 percent by 1970, to 36 hours per week, 50 weeks of the year, or 1,800 hours per worker per year.

The computation of the estimate of employment. It is necessary to make slight adjustments of the basic formulas when using index numbers.

Industry C - 1970

$$\frac{\text{Production index}}{\text{Output per man-hour index}} \times 100 = \text{man-hours index}$$

$$\frac{120}{110} \times 100 = 109.1$$

$$\frac{\text{Man-hours index}}{\text{Man-hours per worker index}} \times 100 = \text{workers index}$$

$$\frac{109.1}{90} \times 100 = 121.2$$

$$\frac{\text{Workers index}}{100} \text{ (workers 1960)} = \text{workers 1970}$$

$$\frac{121.2}{100} \times 1{,}000 = 1{,}212$$

Conclusion: The estimated employment level of Industry C in 1970 is 1,212. Note the use of figures identical with those in Example 1; actually the two methods are the same.

The analytical document for noncommodity producing industries such as commerce, financial institutions, and service industries is somewhat different from that described above. The purpose is the same, to consider all factors affecting future employment and to arrive at judgments as to the future level of employment. The analyst seeks a meaningful relationship between employment and any available measure of the industry's activity which can be independently projected.

For example:

Employment in banks may be related to bank deposits.

Employment in retail trade may be related to gross sales.

Employment in barber shops and beauty salons may be related to population.

In each case, it is necessary to consider the effect of possible future technological changes, such as the introduction of machinery or automatic equipment, and to anticipate changes in hours worked. From a painstaking evaluation of all factors, the analyst derives an estimate of future employment.

Chapter V. MODIFICATION OF THE FIRST APPROXIMATION (STEP 3)

Modify the first approximation of employment at the future date in accordance with the results of the detailed analysis of each important activity.

Fitting the Conclusions of the Analysis of Important Industries into the Whole

Step 1 provided an estimate of future employment for each industry or economic activity, derived by successive allocation into industries of the estimated total employment of the economy. These estimates have been designated as first approximations. They have been forced so that the sum of the parts equals a predetermined total of employment in the entire economy.

Step 2 provided an independent estimate of future employment in a limited number of important industries, derived by detailed analysis.

The next step (Step 3) is to modify the first approximations of Step 1 on the basis of the more detailed analysis of Step 2. It is inevitable that the detailed analysis will in some cases indicate a need for revision of the first approximation. These modifications should be made; an upward revision in one industry may be balanced by a downward adjustment in another so that the sum of the parts will still equal the total. Balance among industries should be considered as well; the level of employment in related industries should be consistent. If sufficient data are available for earlier years, the relationship among industries can be tested by correlation analysis.

This final evaluation and adjustment will produce the revised estimates of future employment by industry, which the analyst presents as his best answer to the question "How many people will be required in each industry at the given future date?"

Verification by Analysis of Gross Domestic Product

In order to provide a further check against the reasonableness of the industry employment projections, it is suggested that an attempt be made to determine whether these projections (and the assumptions on which they are based) are consistent with overall projections of gross national or domestic product. If, for example, the economic development plan for the country envisages an annual increase in gross product of 3 or 4 percent, the projections of employment by economic activity should be consistent with that rate of increase.

This analysis cannot be expected to be precise; rather, it is a blunt tool which permits examination of the effect on the total economy of the various assumptions incorporated into the forecasts. It may reveal, for instance, that a productivity assumption which appeared reasonable, is, in fact, inconsistent with the anticipated growth of the economy.

The verification begins with the level of gross domestic product in the base year. If the system of national accounts used in the country conforms with the standards recommended by the Statistical Office of the United Nations 28/, there is a standard table number II entitled, "Industrial origin of Gross Domestic Product at factor cost," which may be available for use. This table provides an estimate of the contribution of each economic activity to gross domestic product for a base year.

The procedure recommended here utilizes that table to check the forecasts, as follows: For each economic activity: (1) The contribution to gross domestic product at factor cost (base year), (2) Divided by: Employment in the economic activity (base year), (3) Equals: gross domestic product per person employed (base year).

When gross domestic product per person employed is known for each economic activity for the base year, an estimate of that product for the future year may be derived, consistent with the assumptions which have been incorporated into the preceding projections. That is, the assumptions regarding the anticipated changes in productivity and hours worked may be applied to the gross domestic product per person employed for each economic activity to derive a corresponding estimate for the future period. Then, for each economic activity: (4) Estimated contribution to gross domestic product per person employed in the future year, (5) Multiplied by: Estimated employment in the future year, (6) Equals: The contribution to Gross domestic product at factor cost for the future year.

The sum of the contribution to gross domestic product from all economic activities for the future year provides an estimate of the total future gross domestic product. Utilizing that figure, it is possible to compute the percentage change from the base year to the future year in gross domestic product. Derive the ratio:

$$\frac{\text{Gross domestic product at factor cost for the future year}}{\text{Gross domestic product at factor cost for the base year}}$$

If the above procedure indicates that the future gross domestic product implied by the forecast is not consistent with overall expectations, it may point to the need for some modification of the assumptions used.

An example of the projection of gross national product by this type of analysis is provided by Australia in its reply to the United Nations questionnaire on long-term economic projections. 29/

Gross National Product. Australian industry was classified into 119 sectors and then an extrapolation was made of the expected labour input

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28/ United Nations, Statistical Office, A System of National Accounts and Supporting Tables (New York, 1960), Studies in Methods, Series F, No. 2, rev. 1.

29/ United Nations, Economic and Social Council, World Economic Situation, Evaluation of Long-Term Economic Projections (New York, 1960), E/3379, Adden. 1, Reply of Australia, p. 15.

coefficient in 1964-65 for each of the 119 industries. Using these extrapolations of labour productivity and 1953-54 employment weights (except for rural industries), a projection of Gross National Product for 1964-65 was obtained.

Labour productivity in the rural sector was estimated to increase by 28 percent from 1953-54 to 1964-65. Aggregate rural employment was estimated, however, not by using 1953-54 employment weights, but by assuming that the figure will remain constant at slightly less than 0.5 million persons. This is in line with a trend which has marked the Australian economy for several decades.

In manufacturing, estimates of productivity increase varied from around 5 percent for several foodstuffs to 57 percent for power generation and even higher increases in some engineering activities-the weighted average increase for factories being approximately 19 percent.

Estimates of productivity increases in the service sector varied from 6 percent for railways to 20 percent for commerce, and 40 percent for shipping.

The weighted average of these estimated productivity increases for all industries over the period 1953-54 to 1964-65 was 20 percent or 1.67 percent per annum. Together with an estimate of population increase this allows an initial estimate of Gross National Product for 1964-65. After allowing for a decrease in the terms of trade between 1953-54 and 1964-65, the final estimate of Gross National Product is obtained.

Chapter VI. ESTIMATED FUTURE EMPLOYMENT BY OCCUPATION (STEP 4)

Derive an occupational breakdown of employment in each economic activity in the future period by applying the best available occupational composition patterns with particular attention to all occupations requiring specialized or long-term training or education. Sum the estimates of each occupation from the various economic activities.

The occupational structure of employment can be expected to change significantly as economic development proceeds. Along with the development of new industries and the modernization of traditional industries, there must almost certainly be an increase in the number and proportions of people engaged in professional and technical occupations, and in higher level administrative occupations.

Professor Harbison of Princeton University advances the hypothesis:

> . . . that the accumulation of high-level manpower is related to change and innovation in economic, social, and political activity, i.e., to the progressive introduction over time of new ways of producing goods and services and new patterns of social and political life. According to this hypothesis, human capital formation is associated with both economic, social, and political development. In a static, traditional society one would expect that the proportion of persons in the high-level category would be relatively constant. But, as the traditional society begins to modernize, it must accumulate high-level manpower to staff a new and expanding government service, to introduce new systems of land use and new methods in agriculture, to develop new means of communication, to carry forward industrialization, and to build a system of education. Changes in all these fields require persons with professional and technical skills and organizing ability. 30/

For purposes of the current analysis a judgment must be made as to the extent to which this upgrading of occupational skills will take place, and furthermore, the extent to which the development plans require additional high-level manpower. Even if there appears to be no reasonable expectation of fulfilling the apparent requirements, there is a need for estimating the shortage which is likely to occur. Therefore the following analysis attemps to gauge the extent of the anticipated demand for each occupational category.

Application of Occupational Composition Patterns to Industry Projections

The number of persons to be employed in each occupation in the future period may be estimated by applying the best available occupational composition patterns to the previously derived estimates of

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30/ Frederick H. Harbison, High-Level Manpower, Productivity, and Economic Progress. Paper for Conference on Labor Productivity under the auspices of the International Economic Association, September 1961, pp. 15-16.

employment in each industry or each economic activity. Particular interest centers in those occupations which require specialized training or education. The procedure consists of four steps:

1. Obtain for each economic activity an occupational composition pattern, i.e., a count of the number employed in each occupation or occupational group in the current or base year. Compute the percentage distribution by occupation.

2. Modify the occupational composition pattern, by judgment, to take into account changes anticipated in occupational structure in the forecast period.

3. Multiply the projected industry total by the percentage in each occupation to derive the estimated number in each occupation in the future year.

4. Sum the occupational estimates from all economic activities.

The chief problem is to obtain the desired occupational information. It is necessary to investigate possible sources of the data.

In some countries, the Census of Population includes a count of the working population according to the industry and occupation of each worker. Thus, the census yields information on the occupational composition of each industry. [31] Perhaps there are other occupational studies or skill surveys made by government agencies.

The various industries may be able to provide occupational data. Staffing patterns for individual establishments, groups of establishments, or entire industries may be available. It may be possible to obtain and use relevant information from other more economically advanced countries, particularly for industries which do not yet exist in the country but are expected to be established in the future. Patterns from other countries, however, should be used cautiously, with careful attention to the differences as well as the similarities between industries in different economic environments.

In the event that current occupational composition patterns for some or all industries are available, these patterns must be modified for forecasting, to take into account anticipated changes in occupations. The tasks performed today by skilled craftsmen may be performed tomorrow by machines operated by semiskilled workers. Routine tasks performed by unskilled workers may be done entirely by machines. The moving of materials and parts by conveyor belts in the factory eliminates some occupations and changes others. Research and development programs in industry are constantly searching for ways of producing goods more efficiently. Every year new ways are found of doing things, each change having some effect upon the functions of workers.

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[31] If such information is not published, perhaps the Census agency will make a special tabulation of the industry-occupation data upon request. There are limitations to the accuracy and reliability of occupational data obtained by household enumeration. Often the housewife supplies the information about the worker; she may have only a general idea of the job duties of the worker and may provide inaccurate information. Many workers and wives tend to upgrade themselves when reporting to the Census; i.e., they report themselves in an occupation which carries more presitge than the one in which they are actually engaged. Or the worker may report a specific title to his occupation which is unique in his plant and thus not susceptible to proper identification and classification by the Census. As a result of such limitations, the Census occupational categories must be rather broadly defined and used with caution.

Some indication of the net changes in occupational structure may be obtained by examining occupational trends in different industries and in different countries. Surveys may be available to indicate the extent of increases in the employment of scientists and engineers in some industries. Current information as to current and anticipated technological changes can be used to make modifications of each industry's occupational composition pattern for use in forecasts.

One analytic technique is to study the occupational composition of plants which have the most up-to-date technology, on the assumption that over a period of years other plants in the industry will introduce the new equipment or production methods and thus the industry as a whole will approach the pattern of the advanced plants.

A pioneer work in the occupational field has been issued by the Planning Commission of the Government of India. 32/ Reproduced here is a summary of the percent distribution of manufacturing employment in India by occupational group and by industry group (table 7). Similar tables from the United States have been included for both manufacturing and nonmanufacturing industries, by occupational group from data obtained in the 1950 Census of Population (tables 8 and 9). The percent distribution of the economically active population by branch of economic activity and by major occupational group for Brazil, Chile, and Guatemala is shown in tables 10, 11, and 12.

If there are no occupational statistics in a given country statistics from other countries such as found in tables 7 through 12 may provide a rough guide to occupational structure. The source publications cited in those tables would, of course, provide greater detail and should be obtained in preference to the summaries provided here.

For example, suppose it has been estimated that employment in the manufacture of stone, clay, and glass products 33/ in the future

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32/ India Planning Commission, Occupational Pattern in Manufacturing Industries, India 1956 (Delhi, 1959).

33/ This major group is called "Manufacture of Stone, Clay, and Glass Products" in the Standard Classification systems of both the United States and India. The corresponding group in the ISIC is called "Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal."

Table 7. Percent Distribution of Estimated Total Employment in India in Manufacturing Industries, by Industry and Major Occupational Groups, 1956

Industry group	Total	Professional, technical, and kindred workers	Administrative, executive, and managerial workers	Clerical and related workers	Sales workers
All industries	100.0	2.24	1.39	4.54	0.04
Food and kindred products	100.0	1.86	1.42	5.24	0.03
Textile mill products and apparel	100.0	1.05	.65	3.06	.01
Chemical and related products	100.0	4.72	2.40	5.71	.10
Rubber, petroleum, and coal products	100.0	4.15	2.02	3.67	--
Stone, clay, and glass products	100.0	2.22	1.66	3.80	.02
Basic metal products	100.0	6.67	2.45	7.91	----
Fabricated metal products and machinery	100.0	3.67	2.40	5.60	.06
Transport equipment	100.0	4.06	1.70	6.65	.03
Other	100.0	2.89	2.02	5.97	.11

Table 7. Percent Distribution of Estimated Total Employment in India in Manufacturing Industries, by Industry and Major Occupational Groups, 1956 —Continued

Farmers, fishermen, hunters, loggers, and related workers	Workers in transport and communications occupations	Craftsmen, production process workers and laborers, unclassified	Service, sport and recreation workers	Industry group
0.03	0.64	89.91	1.21	All industries.
0.02	0.94	88.02	2.47	Food and kindred products.
.01	.13	94.25	.84	Textile mill products and apparel.
.02	.75	85.16	1.14	Chemical and related products.
—	.60	88.36	1.20	Rubber, petroleum, and coal products.
.05	.52	90.44	1.29	Stone, clay, and glass products.
.09	1.39	78.72	2.77	Basic metal products.
.02	.85	86.61	.79	Fabricated metal products and machinery.
—	4.47	82.40	.69	Transport equipment.
.05	.54	87.08	1.34	Other.

Source: Occupational Pattern in Manufacturing Industries, India 1956 (Delhi, 1959).

Table 8. Percent Distribution of Employed Persons in the United States, by Industry and Major Occupational Groups, 1950

Industry group	Total	Professional technical and kindred workers	Managers, officials, and proprietors, except farm	Clerical and kindred workers	Sales workers
Total manufacturing..........	100.0	4.9	4.8	11.0	3.0
Food and kindred products....	100.0	2.7	7.7	11.1	5.4
Textile mill products........	100.0	1.5	2.4	6.2	.9
Apparel, and other fabricated textile products.....	100.0	1.1	4.6	6.6	1.9
Chemicals and allied products	100.0	12.0	6.3	15.1	4.7
Rubber products..............	100.0	5.4	3.5	13.5	2.0
Petroleum and coal products..	100.0	14.0	6.1	16.7	2.4
Stone, clay and glass products	100.0	4.1	5.2	9.2	1.6
Primary metal industries.....	100.0	4.2	2.5	9.7	.7
Fabricated metal industries..	100.0	4.8	5.4	12.1	2.3
Machinery, except electrical.	100.0	6.9	4.9	13.6	2.5
Electrical machinery.........	100.0	9.3	3.3	14.6	1.5
Transportation equipment.....	100.0	6.6	2.4	12.0	.8
Lumber and wood products, except furniture...........	100.0	.9	5.8	3.8	.7
Furniture and fixtures.......	100.0	1.6	5.3	8.0	2.2
Professional and photographic equipment and watches......	100.0	10.4	5.5	16.2	2.5
Tobacco manufactures.........	100.0	1.1	3.6	6.5	2.1
Paper and allied products....	100.0	3.4	4.3	11.2	2.3
Printing, publishing, and allied industries..........	100.0	9.6	8.3	18.4	15.2
Leather and leather products.	100.0	1.2	3.2	7.6	1.7

Table 8. Percent Distribution of Employed Persons in the United States, by Industry and Major Occupational Groups, 1950
--Continued

Craftsmen, foremen, and kindred workers	Operatives and kindred workers	Service workers, except private households	Laborers except farm and mine	Industry group
19.6	46.0	1.9	8.8	Total manufacturing.
15.2	44.9	2.5	10.5	Food and kindred products.
10.5	71.5	2.1	4.9	Textile mill products.
5.9	77.9	.9	1.1	Apparel, and other fabricated textile products.
15.7	33.5	2.9	9.8	Chemicals and allied products.
13.6	53.0	2.6	6.4	Rubber products.
21.3	27.2	2.2	10.1	Petroleum and coal products.
15.5	45.6	1.6	17.2	Stone, clay and glass products.
29.1	33.5	2.3	18.0	Primary metal industries.
24.2	42.7	1.7	6.8	Febricated metal industries.
31.3	34.9	1.8	4.1	Machinery, except electrical.
18.4	47.4	1.8	3.7	Electrical machinery.
28.8	41.9	2.3	5.2	Transportation equipment.
9.9	38.7	1.2	39.0	Lumber and wood products, except furniture.
24.8	50.4	1.3	6.4	Furniture and fixtures.
21.8	39.5	1.7	2.4	Professional and photographic equipment and watches.
7.9	67.9	2.9	8.0	Tobacco manufactures.
14.4	52.7	1.7	10.0	Paper and allied products.
33.6	12.2	1.3	1.4	Printing, publishing, and allied industries.
6.4	75.5	1.2	3.2	Leather and leather products.

Source: _U.S. Census of Population: 1950_. _Vol. IV. Special Reports_ (Washington, U.S. Bureau of the Census, 1955), Pt. 1, Ch. D, Industrial Characteristics. Table 6: _Major Occupation Group of Employed Persons, by Detailed Industry and Sex, for the United States, 1950_.

Table 9. Percent Distribution of Employed Persons in Nonmanufacturing Industries in the United States, by Industry and Major Occupational Groups, 1950

Industry group	Total	Professional, technical, and kindred workers	Managers, officials, and proprietors, including farm	Clerical and kindred workers	Sales workers
Agriculture, forestry, and fisheries..........	100.0	0.7	61.4	0.3	0.1
Mining....................	100.0	3.7	4.1	4.6	.3
Construction..............	100.0	3.8	8.4	3.2	.3
Transportation, communication, and other public utilities........	100.0	3.5	7.0	23.5	.5
Wholesale and retail trade	100.0	2.0	23.1	11.5	27.8
Finance, insurance and real estate............	100.0	3.3	16.9	42.0	23.7
Services 1/..............	100.0	31.9	6.0	9.6	.9
Public administration 2/..	100.0	12.0	9.2	44.2	.2

1/ Business and repair services; personal services; entertainment and recreation services; and professional and related services.

2/ Includes only those activities which are unique to government, such as legislative and judicial activities and most of the activities in the executive agencies. Government agencies engaged in educational and medical services and in activities commonly carried on also by private enterprises, such as transportation and manufacturing, are classified in the appropriate industrial category.

Table 9. Percent Distribution of Employed Persons in Nonmanufacturing Industries in the United States, by Industry and Major Occupational Groups, 1950 —Continued

Craftsmen, foremen, and kindred workers	Operatives and kindred workers	Service workers	Laborers, except mine	Industry group
0.3	0.8	0.2	36.2	Agriculture, forestry, and fisheries.
17.4	69.1	.7	.1	Mining.
57.0	7.6	.5	19.2	Construction.
21.3	27.9	3.4	12.9	Transportation, communication, and other public utilities.
6.1	12.6	13.7	3.2	Wholesale and retail trade.
2.3	.7	9.3	1.8	Finance, insurance and real estate.
9.2	8.1	32.0	2.3	Services 1/.
8.5	4.8	16.3	4.8	Public administration 2/.

Source: *U.S. Bureau of Census of Population: 1950*. *Vol. IV, Special Reports* (Washington, 1955). Pt. 1, Ch. D, Industrial Characteristics. Table 6: *Major Occupation Group of Employed Persons, by Detailed Industry and Sex, for the United States, 1950*.

Table 10. Percent Distribution of Economically Active Population in Brazil by Branch of Economic Activity and Major Occupational Group, 1950

Branch of economic activity	Total	Professional, technical and related workers	Managers, administrators, and officials	Clerical office and related workers	Salesmen and related workers	Farmers, fishermen, hunters, lumbermen and related workers
Total	100.0	2.0	3.6	4.1	3.2	59.1
Agriculture, forestry, hunting, fishing, mining, and quarrying	100.0	--	0.3	0.1	--	96.9
Manufacturing, construction, electricity, and gas	100.0	1.2	4.4	7.8	1.9	1.5
Commerce	100.0	1.5	33.6	14.3	43.1	.3
Transport, storage, and communications	100.0	.4	3.8	15.6	.2	1.5
Services, water, and sanitary services	100.0	11.2	3.9	9.3	1.5	1.8

Note: Because of rounding, sums of individual items do not necessarily equal totals.

Table 10. Percent Distribution of Economically Active Population in Brazil by Branch of Economic Activity and Major Occupational Group, 1950 --Continued

Workers in mine quarry and related workers	Workers in operating transport occupations	Craftsmen, factory operatives, and workers in related occupations	Manual workers and laborers not elsewhere classified	Service and related workers	Other workers n. e.c. and workers in occupations unidentifiable or not reported	Branch of economic activity
2.0	2.3	11.3	2.6	5.9	3.7	Total.
0.6	0.5	0.5	0.7	--	0.3	Agriculture, forestry, hunting, fishing, mining, and quarrying.
11.3	1.5	51.8	9.0	0.3	9.2	Manufacturing, construction, electricity, and gas.
--	1.0	2.3	1.2	.1	2.7	Commerce.
.5	39.5	14.2	17.1	.6	6.5	Transport, storage, and communications.
.4	.9	22.3	1.3	36.9	10.6	Services, water, and sanitary services.

Source: Union Panamericana, Instituto Interamericano de Estadistica, *La Estractura Demographica de las Naciones Americanas*. Volume II, Tomo 2. Caracteristica combinadas de la poblacion economicamente activa. Cuadro 21-12, pp. 112-125.

Table 11. Percent Distribution of Economically Active Population in Chile by Branch of Economic Activity and Major Occupational Group, 1952

Branch of economic activity	Total	Professional, technical and related workers	Managers, administrators, and officials	Clerical office and related workers	Salesmen and related workers	Farmers, fishermen, hunters, lumbermen and related workers
Total..............	100.0	4.3	6.4	7.5	2.5	28.2
Agriculture, forestry, hunting, and fishing.......	100.0	0.4	0.2	0.7	0.1	93.9
Mining and quarrying.........	100.0	2.4	1.1	6.2	.3	--
Construction........	100.0	2.1	5.7	2.5	.2	--
Manufacturing industries........	100.0	2.3	5.0	5.9	1.7	--
Electricity, gas, water, and sanitary services.....	100.0	4.2	1.0	14.7	.5	--
Commerce............	100.0	2.2	40.3	22.0	19.5	--
Transportation, storage, and communications....	100.0	1.6	2.4	21.3	.3	--
Services............	100.0	14.0	3.3	8.1	.4	--

Note: Because of rounding, sums of individual items do not necessarily equal totals.

Table 11. Percent Distribution of Economically Active Population in Chile by Branch of Economic Activity and Major Occupational Group, 1952 --Continued

Workers in mine quarry and related workers	Workers in operating transport occupations	Craftsmen, factory operatives, and workers in related occupations	Manual workers and laborers not elsewhere classified	Service and related workers	Other workers n.e.c. and workers in occupations unidentifiable or not reported	Branch of economic activity
2.8	2.4	23.8	1.9	13.9	6.3	Total.
--	0.3	2.2	0.1	0.7	1.4	Agriculture, forestry, hunting, and fishing.
59.2	2.4	22.7	1.4	2.9	1.4	Mining and quarrying.
--	1.2	66.4	17.1	2.3	2.6	Construction.
--	1.4	78.1	.8	1.6	3.1	Manufacturing industries.
--	3.0	51.7	1.0	10.8	13.0	Electricity, gas, water, and sanitary services.
--	1.6	8.5	.8	2.8	2.2	Commerce.
--	34.9	24.2	10.4	2.5	2.2	Transportation, storage, and communications.
--	.5	3.0	1.1	56.8	12.8	Services.

Source: Union Panamericana, Instituto Interamericano de Estadistica. La Estractura Demographica de las Naciones Americanas. Volume II, Tomo 2. Caracteristica combinadas de la poblacion economicamente activa. Cuadro 21-17, pp. 142-155.

Table 12. Percent Distribution of Economically Active Population in Guatemala, by Branch of Economic Activity and Major Occupational Group, 1950

Branch of economic activity	Total	Professional, technical and related workers	Managers, administrators, and officials	Clerical office and related workers	Salesmen and related workers	Farmers, fishermen, hunters, lumbermen and related workers
Total..............	100.0	1.6	1.5	1.8	3.3	67.3
Agriculture, forestry, hunting, and fishing......	100.0	0.1	--	0.2	--	98.5
Mining and quarrying........	100.0	1.7	1.5	2.6	0.1	3.8
Construction.......	100.0	.8	1.0	.7	--	.2
Manufacturing industries.......	100.0	.3	.5	.9	.5	.6
Electricity, gas, water, and sanitary services....	100.0	1.4	1.0	13.7	.2	.1
Commerce...........	100.0	.8	20.9	5.4	59.5	.2
Transportation, storage, and communications...	100.0	1.3	2.0	16.6	.2	.2
Services...........	100.0	14.0	2.0	9.6	.2	1.1

Table 12. Percent Distribution of Economically Active Population in Guatemala, by Branch of Economic Activity and Major Occupational Group, 1950 --Continued

Workers in mine quarry and related workers	Workers in operating transport occupations	Craftsmen, factory operatives, and workers in related occupations	Manual workers and laborers not elsewhere classified	Service and related workers	Other workers n.e.c. and workers in occupations unidentifiable or not reported	Branch of economic activity
0.3	1.2	14.0	1.7	6.3	1.0	Total.
--	0.2	0.6	0.1	0.3	--	Agriculture, forestry, hunting, and fishing.
77.7	1.8	5.8	2.7	1.6	0.8	Mining and quarrying.
.1	2.0	69.2	24.5	1.0	.5	Construction.
1.2	.5	94.3	.9	.2	.2	Manufacturing industries.
.5	.9	63.1	14.6	3.2	1.3	Electricity, gas, water, and sanitary services.
--	1.0	5.5	5.0	1.4	.2	Commerce.
--	45.9	12.9	18.5	1.7	.7	Transportation, storage, and communications.
--	1.8	1.6	3.1	60.1	6.5	Services.

Source: Union Panamericana, Instituto Interamericano de Estadistica, La Estractura Demographica de las Naciones Americanas. Volume II, Tomo 2. Caracteristica combinadas de la poblacion economicamente activa. Cuadro 21-21, pp. 168-179.

year will be 5,000 workers. Reference to the suggested tables indicates that in that industry group in India in 1956, 2.2 percent of total employment was in the occupational group, "Professional, technical, and related workers." The corresponding figure for the United States in 1950 was 4.1 percent. As might be expected, in the more industrialized economy a larger proportion of workers are engaged in the higher level occupations. If possible, consideration should be given to the comparability of the industries in question to those of India or the United States. If, for example, a judgment is made that the industry in the given country is somewhat more advanced than that of India, but less than that of the United States, it would appear reasonable to assume that the proportion of total employment in that occupational group would be between 2.2 and 4.1 percent.

Each occupational group in the stone, clay, and glass major industry group can be roughly estimated on the basis of the following data from tables 7 and 8.

The stone, clay, and glass manufacturing industry group:

United States, 1950	Percent
Professional, technical, and kindred workers........	4.1
Managers, officials, and proprietors................	5.2
Clerical and kindred workers....................	9.2
Sales workers................	1.6
Craftsmen, foremen, and kindred workers...........	15.5
Operatives..................	45.6
Laborers....................	17.2
Service workers.............	1.6

India, 1956	Percent
Professional, technical, and related workers.........	2.2
Administrative, executive, and managerial.............	1.7
Clerical and related workers....................	3.8
Sales workers.................	.02
Craftsmen, production process workers, and laborers.......	90.4
Transportation and communication workers.............	.5
Service workers..............	1.3

Similarly, the occupational groupings in the construction industry in three countries seem to show a pattern related to the level of economic development. In the tabulation which follows, the countries are arranged in order of development, with the most highly developed first.

Occupational group	Proportion of each occupational group to total employment in the construction industry		
	United States (1950)	Chile (1952)	Guatemala (1950)
All groups	100.0	100.0	100.0
Professional, technical, and kindred workers	3.8	2.1	0.8
Managers, officials, and proprietors	8.4	5.7	1.0
Clerical and kindred workers	3.2	2.5	.7
Sales workers	.3	.2	—
Craftsmen, foremen, and kindred workers	57.0	66.4	69.2
Operatives	7.6		
Laborers	19.2	17.1	24.5
Service workers	.5	2.3	1.0
Other workers	----	3.7	2.8

Occupational Grouping

The amount of detail in the occupational distribution will depend upon the availability of data. It is not feasible to project each highly specific occupational category since the estimates are not sufficiently precise for that purpose. But within broad groupings of occupations certain ones must be identified to the extent possible, according to the following criteria:

1. Occupations of strategic importance to the development program.

2. Occupations for which shortages exist in the current economy.

3. Occupations which require long periods of training and into which new workers cannot be readily recruited.

4. Occupations which are important "feeder" occupations to the highly skilled occupations in short supply.

In addition, residual categories should be set up to make it possible to estimate total employment for each major occupational group within each industry division.

There will undoubtedly be gaps in the information available; that is, for certain industries no available data will be applicable. It is suggested for such industries that some reasonable hypothetical distribution of occupations be derived from the overall occupational composition of an industry or industry group with similar characteristics and applied to the projected employment total. In this way, it is possible to estimate for given industries a complete occupational distribution of employment at the future date.

Verification or Modification of Estimates for Certain Occupations

There are a few occupations for which the demand is directly related to a factor which can be independently projected. The number of teachers required, for example, is affected by the number of pupils and by trends in the ratio of teachers to pupils. Projections of population by age group will provide an estimate of the number of children in the future population. Educational plans will provide some guidance to the expected improvement in the proportion of population in school and the improvement in teacher-pupil ratios. Thus, an independent estimate of the number of teachers required at the target date may be derived and incorporated into the occupational breakdown.

The number of physicians needed can be related to the population growth with allowance for changes in the organization of medical services. If the existing ratio of physicians to population in the country as a whole is considered to be below a desirable standard, a higher ratio may be used to estimate future needs. The higher ratio could be that found in an area of the country better served by physicians, the ratio in some other country, or a target figure based on expert opinion concerning needs. For a limited number of occupations, such intensive study of the factors affecting employment can furnish the basis for direct estimates in the context of the estimated growth of population.

Summary of Occupational Estimates

In countries where basic data are sufficient to permit the development of future employment estimates by industry and by occupational group, it will be a relatively routine matter to summarize the estimates to derive a model of the future employment structure of the country. Some classification problems may be encountered, however, since the occupational titles and the amount of detail may vary from industry to industry, and thus the occupations will not be additive. These problems may be resolved only by classifying all occupations into the appropriate occupational groups and presenting the summary by group. For instance, it may be possible to estimate requirements in the professional, technical, and kindred workers occupational group, yet not be able to estimate the required number of chemists or physicists.

In countries where Condition 1 prevails (e.g., no statistics available for the overall economy) and the most important industries are analyzed, the future occupational requirements in those industries will represent minimum requirements. Presumably total requirements for specific occupations will be somewhat greater than the number indicated for the major industries. The forecast may be expressed as a range between a minimum and a maximum estimate. Such limited forecasts will provide useful indications of the dimension of the expected manpower shortage.

Chapter VII. ESTIMATING TRAINING NEEDS FOR EACH OCCUPATION (STEP 5)

Estimate training requirements for each important occupation by analysis of the expected supply of qualified workers, in comparison with the requirements as indicated by occupational estimates for the future period.

Education and training at all levels is one of the crucial needs of the country which is embarked upon a program of economic development. Of particular concern at this stage of the present analysis are the training requirements for those high-level occupations which require long term education and training or specialized skills. To estimate the number of people who need to be trained to meet future requirements in specific occupations, it is necessary to determine the size of the present supply of qualified workers and estimate the potential increments to and losses from this supply.

The detail into which the occupational groups are subdivided for this analysis will depend upon the degree of detail of the source data. It may be general, by broad occupational group, or specific, by detailed occupation, such as that of chemist, and physicist. The general statement is safer and less subject to error; the specific statement is more useful, particularly to educators and vocational counselors, to the extent that it calls attention to real differences in outlook among occupations.

The analysis proceeds as follows:

1. Determine the current "pool" of qualified workers in each occupational category.

2. Deduct outflows. Estimate the number of retirements, deaths, and transfers out of the occupation during the period under study.

3. Add inflows. Estimate the number of entrants to the occupation from college and university courses, vocational schools, apprenticeship programs, on-the-job training and upgrading of skills, and other channels.

4. Equals potential supply of workers to the occupation.

5. Comparison with anticipated requirements indicates shortage or surplus of workers and provides estimates of training needs.

The Current "Pool" of Qualified Workers

The potential current supply of workers for each occupation may be defined as those who are currently employed in the occupation, plus others qualified for and capable of working in the occupation but who are not so engaged.

Thus, the number of persons qualified for employment in an occupation will usually be larger than the number actually employed and hence the supply must be viewed as elastic. Presumably additional numbers would enter or reenter an occupation if inducements were offered and if adequate recruitment and placement services were available and utilized.

It is virtually impossible to measure the size of these marginal groups, but they can be identified for purposes of analysis.

People currently engaged in another occupation. There are many individuals with multiple skills. Circumstances determine the particular jobs at which they work but a change in the labor market situation could cause occupational shifting. For instance, a qualified chemist may be employed as a teacher; a qualified teacher may be employed as the proprietor of a dry cleaning establishment.

People currently not in the labor force. Retired people and married women who have withdrawn from the labor force often possess valuable skills. These persons may reenter the labor market if refresher training courses are offered or if other inducements make employment attractive to them.

People with borderline occupational skills. Employers' standards change with the exigencies of the labor market. Workers whose qualifications are not quite up to a specific standard may be hired under certain labor market conditions and may develop the desired skills on the job. They might not have such an opportunity if there were more highly qualified competitors.

People currently unemployed. Unskilled workers generally constitute the bulk of the unemployed in any country, but there are exceptions. In some cases artificial barriers, such as discrimination against women, older workers, or minority groups, prevent the full utilization of these groups. Hence, some persons possessing scarce occupational qualifications may be among the unemployed. Thus it can be recognized that in most occupations, an unknown number of additional qualified workers may be available. This factor cannot be measured but should be borne in mind when considering the training requirements for any given occupational group.

Estimating Outflows

The term outflow is used to designate the number among the employed and qualified who will leave the occupation for any reason during the period under study.

Outflows are considered in three categories: (1) Deaths and retirements; (2) Transfers to other occupations; and (3) Emigration.

Deaths and retirements. To estimate the number of deaths among the members of an occupational group it is necessary for each year under study to apply an estimated annual mortality rate to the estimated total qualified workers. (a) If the age-sex composition of an occupational group is known or can be estimated, specific mortality rates of the general population may be applied to derive an estimate of the number of deaths expected each year. Mortality rates for specific occupations may be different from the rates of the general population; if any specific information on this point is available it should be used. The most significant factor is the age-sex composition of the group, although there may be specific hazards to be considered in certain occupations. (b) If mortality rates for the population are not available it is suggested that mortality rates for the population of a different country be used, on the basis of whatever knowledge there is about life expectancy. Generalized mortality rates as associated with given levels of life expectancy are published by the United Nations.[34] For example, in estimating deaths among high-level occupations in Ghana, the previously cited study "Survey of the High-Level Manpower in Ghana, 1960" reports:

> It was assumed that life expectancy of males, aged 20, was a suitable measure of mortality experience of the labor force. Accordingly the range of life expectancy in a number of populations which might be thought analagous to that of Ghana was examined for clues to high and low estimates for Ghana:

Selected Rates of Mortality of the Labor Force (expressed as life expectancy of males, aged 20)

Upper limits

India	33
Belgian Congo (1950-52)	34
Ceylon (1920-22)	35

"High" mortality

South Africa (1945-47)	37
Mexico (1940)	38
Puerto Rico (1934-36)	39
Trinidad (1930-32)	37

"Low" mortality

Trinidad (1954-56)	46
US Negro (1955)	46
Jamaica (1950-52)	45
Ceylon (1947)	46

Lower limits

Ceylon (1952)	49

> From these data it was determined more or less arbitrarily to use mortality tables approximating life expectancy at age 20 of 37 and 45 years, respectively, for the 'high' and 'low' mortality estimates for Ghana. These were selected from the model life tables for underdeveloped countries published by the United Nations.[35]

Retirements are estimated on the basis of the known or assumed age composition of those employed in the occupation, estimating the number who will reach a predetermined retirement age at each year in the future, after subtracting the estimated deaths.

In the United States, a technique has been developed which provides a pattern of labor force participation entitled "Tables of Working Life." These tables follow a cohort of 100,000 workers through successive years showing the rate of attrition caused by deaths, retirements, and withdrawals, and thus provide a basis for estimating deaths and retirements in the future. Annual death and retirement rates for men in the United States range from less than 1 percent per annum to more than 3 percent in various occupations, depending on the age composition. For women workers, the withdrawal rate is as high as 7 percent in some occupations, reflecting the effects of marital status and childrearing on women's work patterns. 36/

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[34] United Nations, Age and Sex Patterns of Mortality (New York). ST/SOA/Series A, Population Studies No. 22.

[35] Survey of High-Level Manpower In Ghana, op. cit., p. 58. Life expectancy expresses the average number of remaining years of life. Thus life expectancy at age 20 of 40 years means the average expectation of living to age 60.

These tables are applicable only in the United States since they are based upon mortality and retirement experience in the United States. If similar tables of working life are available in the country being studied, or from a country with comparable experience, they would constitute a useful tool in estimating outflows.

In the Ghana study, the U.S. tables of working life were utilized as follows:

> The experience for the United States shown in the 'Length of Working Life' by Seymour L. Wolfbein was used as a point of departure; it was assumed that there was an inherent correlation between death rates and retirement rates, since both are related to biological aging, even though customs and other socioeconomic factors are also involved, and at certain ages may be controlled. Enquiries concerning retirement customs in Ghana revealed that the customary age of retirement is 55, corresponding to 65 in the United States. Accordingly, the retirement rates shown by Wolfbein for the United States, 1955, were used, but applied to Ghanaian age classes 10 years younger; e.g., United States rates for 65-69 applied to Ghanain age 55-59. 37/

Transfers to other occupations. In a developing country where skills are in short supply, it may be expected that opportunities will arise for workers to move up the occupational ladder through various kinds of upgrading and training, both formal and informal. As an economy moves further away from the traditional agricultural-handicraft structure toward industrialization, workers in considerable numbers move from the unskilled category into the semiskilled, skilled, administrative and managerial occupations, and into the professions. This type of occupational mobility continues even in a highly industrialized nation.

For example, one of the conclusions of a study of occupational mobility in the United States is as follows:

> The single most important component in determining the rate of growth of an occupation

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36/ United States Department of Labor, Bureau of Labor Statistics, Tables of Working Life for Men. Tables of Working Life for Women (Washington, 1950). Bulletins 1001 and 1204, respectively. Seymour L. Wolfbein, Length of Working Life (Paper presented before the Fourth International Gerontological Congress, Merano, Italy, July 1957).

37/ Survey of High-Level Manpower in Ghana, op. cit., p. 58.

during any decade is the volume and direction of net mobility. Occupations which grow rapidly are those into which there is considerable net mobility. Large numbers of new entries from among youths who are entering the working force is not enough to insure the growth of an occupation. On the other hand, the occupations which either grow slowly or decrease in size do so because of large-scale net out-mobility rather than because youth do not enter them or because of retirements or deaths. 38/

The occupational distribution of a specific cohort of men, aged 15 to 24 years in 1930, was compared with the occupational pattern of the same men in 1950 when the survivors were 35 to 44 years of age.

	Percent distribution	
	1930	1950
Total	100.0	100.0
Professional, technical, and kindred workers	2.9	6.8
Farmers and farm managers	5.2	12.6
Managers, officials, and proprietors, except farm	2.5	11.0
Clerical and kindred workers	8.9	5.5
Sales workers	5.8	6.1
Craftsmen, foremen, and kindred workers	10.4	18.4
Operatives and kindred workers	19.6	18.2
Service workers	3.8	6.2
Farm laborers and foremen	24.7	4.3
Laborers, except farm and mine	16.2	10.9

Inspection of these pictures of the occupational distribution of the same men taken twenty years apart clearly indicate that substantial mobility has occurred. Obviously there was considerable net mobility into the groups:

- Professional, technical, and kindred workers
- Farmers and farm managers
- Managers, officials, and proprietors, except farm
- Craftsmen, foremen and kindred workers
- Service workers

There was also considerable net mobility out of:

- Clerical and kindred workers
- Farm laborers and foremen
- Laborers, except farm and mine

38/ A.J. Jaffe and R.C. Carleton, Occupational Mobility in the United States 1930-1960 (New York, King's Crown Press, 1954), p. 27.

With respect to the two remaining groups, sales workers and operatives, perhaps in-and-out mobility almost balanced each other. 39/

Additional insight into the patterns of mobility in the United States is gained by an analysis of work histories of individual workers. Jaffe and Carleton present an analysis of patterns of working life based on data from the study Labor Mobility in Six Cities. 40/ This analysis confirms the findings cited above, and provides information about individual workers which permits a more precise picture of the types of occupational changes that take place.

The following is a summary of the outflows and inflows to and from occupational groups in relation to (a) those who started their working career in the given occupational group, and (b) those who were in the given group at the end of their working careers: 41/

Professional, technical, and kindred workers. Of 1,000 young men who enter this major occupational group and survive 40 years, about one-third remain throughout their working lives. Another one-third become either managers, officials, proprietors, or clerical and sales workers. About one-third end their careers as manual workers: perhaps one-sixth are skilled craftsmen, and one-sixth operatives, service workers, or common laborers.

Of men in this occupational group at the end of their working careers, one-quarter had begun as professionals; one-quarter worked their way up from clerical and sales positions; one-quarter had begun as operatives; and about one-tenth had their first jobs as craftsmen or foremen; one-tenth as laborers; the rest had come from the other occupational categories.

Managers, officials, and proprietors, except farm. Of 1,000 young men who enter this occupational group prior to age 25, about one-quarter remain to the end of their working careers; about one-fifth become clerical and sales workers; about 8 percent enter the professions; almost half become manual workers, about equally divided between craftsmen and other manual jobs.

Of all men in this group at the end of their working lives only about one-third began as white-collar workers, largely at the clerical level. One-eighth began as craftsmen; three-tenths as operatives; two-tenths as laborers; a few in service occupations.

Clerical and sales workers. Of those who enter this group as young men, almost one-fifth (18 percent) remain to the end of their working lives. The remainder shift as follows: 22 percent to craftsmen and foremen; 22 percent to managers, officials, and proprietors; about 10 percent to the professions; about 17 percent to operatives; the rest to the unskilled groups.

39/ Ibid, p. 35.

40/ Gladys Palmer, Labor Mobility in Six Cities (New York, Social Science Research Council, 1954).

41/ Jaffe and Carleton, op. cit., pp. 54-57

Of all clerical and sales workers at the end of their careers, about one-quarter had begun in this occupational group. Three-tenths began as operatives; one-tenth as craftsmen; one-tenth in professional and managerial occupations; the remaining one-quarter in unskilled work.

Craftsmen, foremen, and kindred workers. Of 1,000 youths in this group one-third remain, one-third enter white-collar (professional, managerial, clerical) occupations, and one-third move into less skilled manual jobs.

Of all men in this group at the end of their careers, about one-third began as operatives, one-fourth as laborers, a few as service workers. Less than one-fifth began as skilled workers, and one-fifth began in white-collar occupations.

Operatives and kindred workers. Of young men entering this group, about one-fifth remain operatives for their entire working life; about one-third enter white-collar occupations, mostly managerial, clerical, and sales jobs but a few professionals; about one-third become craftsmen; a tenth enter service occupations; a few become laborers.

Those who are operatives at the end of their working lives began at all occupational levels; one-third began as operatives, one-fifth in white-collar jobs, one-tenth craftsmen, one-quarter as laborers, and the rest in service occupations.

The extent to which individuals move from one occupation to another varies with the customs and economic conditions of different countries. The mobility experience of the United States, as cited above, will not be applicable in another country since the labor force of the United States is probably the most mobile in the world. However, this summary may suggest the dimensions of the problem and indicate areas of research which would be helpful in manpower programs in other countries.

Emigration. When considering potential outflows, it must be recognized that some workers will leave the country permanently. Foreign nationals currently working in the country may return to their homes. When large numbers of students study abroad, some of them are likely to emigrate permanently.

When emigration is significant, some allowance must be made for it in estimating future supply of workers even though it is difficult to forecast.

For example, emigration has been an important factor limiting the labor force growth of Puerto Rico. During the early 1950's, an average of 50,000 persons per year migrated to the United States. In forecasting manpower supply the Puerto Rico study assumes that migration will continue to 1975 at the same average level as in the 1950's. To quote from the study:

> We have assumed that the net migrant population will continue to have the age-sex composition that it had between 1953 and 1955. Data for these years shows that the great majority of the migrants are less than 30 years of age. The

ratio of the sexes is about even but men migrate in largest numbers between the ages of 20 and 30 while women migrate more evenly at all ages. After 30 years of age there is a net migration to Puerto Rico which accounts for the fact that our population projection shows equal or slightly larger numbers of persons in the age groups 35-44 and 45-54 than in the 25-34 year age group.

It is also assumed that net migrant population will have the same educational composition as the total population. This assumption leads to conservative estimates of manpower shortages and surpluses by education level. The data we have, although inconclusive, strongly indicate that in the past a higher proportion of persons with more than average education for their age and sex groups have been included among the net migrants. Analysis of the age structure of the population in the United States also indicates that the job attractions of the States will be strongest for the Puerto Rican age and sex groups which have already been most depleted. On the other hand, since our estimates show that these same age, sex, and education groups will be in short supply in Puerto Rico, we may be warranted in our previously stated assumptions.

The numbers involved in our net migration estimates are so large as to make our migration assumptions easily the most important factor in our estimates of future manpower supply. [42]

Estimating Inflows

The term "inflow" is used to designate the numbers of people who will enter the occupation during the period under study. Major elements of the inflow to an occupation in the high-level category are:

1. Graduation from appropriate educational institutions and apprenticeship programs.
2. Completion of training abroad.
3. Entrance without completing formal training.
4. Transfers from other occupations.
5. Immigration.

Graduations. For a limited number of occupations, entrance to employment requires a specific course of education or training. In making projections of future inflows through graduations, it is necessary to distinguish between those resulting from completion of courses by students currently enrolled in the various courses, and those further in the future resulting from completion of training by students who have not yet begun the training.

If a count of students currently enrolled is available, allowance should be made for expected dropouts on the basis of past experience, thus deriving a fairly accurate count of the number of graduates expected in the next 3 or 4 years.

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[42] Puerto Rico's Manpower Needs and Supply, op. cit., p. 50.

Long-term projections of future graduates, beyond the completion date of students presently enrolled, can be based upon the population projections by age group. This requires an assumption of the proportion of each age group who will be completing each level of education in the future years, and assumptions as to the distribution of such students among the various courses.

Apprenticeship programs and vocational school training graduate each year a number of persons with the skills required to enter various crafts. In the United States and many other countries, formal apprenticeship programs provide only a small proportion of the entrants to the skilled trades. Consideration must obviously be given to the relative importance of apprenticeship programs and vocational schools in each country. Projections of future enrollments and completions can be made on the basis of a knowledge of current programs and expected future expansion, with appropriate allowance for dropouts.

In some countries, education officials have made projections of enrollments, dropouts, and completion of training for the various sectors of the educational system.

Completion of training abroad. This component of future inflows may be negligible in some countries, but quite important in countries which traditionally send many young people abroad for higher education. If so, an attempt should be made to find out the number of students abroad, their age, sex, field of study, and expected completion date.

Entrance without completing formal training. In most countries, substantial numbers of the people who drop out of the formal training programs are able to enter an occupation on the basis of their partial training. Some insight into the extent to which this practice prevails may be acquired by conducting a survey of persons currently engaged in such occupations. A study in the United States, 43/ for instance, revealed that 21.6 percent of the professional engineers had not completed the formal education normally considered as a requirement for entrance to the occupation.

Transfers from other occupations. Inflows from other occupations are an element of the occupational mobility discussed above under "outflows." The two must be estimated together since, for the labor force as a whole, outflows and inflows between various occupations must balance.

An examination of the educational and experience background of members of a specific occupation such as may be available from a register of members of a professional society, may reveal information about occupational transfers. Similarly, a followup study of the graduates of institutions of higher

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43/ United States Department of Labor, Bureau of Labor Statistics, Scientific and Technical Personnel in American Industry. Report on a 1959 Survey (Prepared for the National Science Foundation, 1961), p. 15.

education and/or apprenticeship training would be useful in determining the nature and volume of occupational shifts.

Immigration. Future immigration represents a potential source of workers at all levels of the occupational hierarchy. If immigration is expected to be significant, some allowance must be made for it.

For example, Australia admitted more than 1.2 million immigrants in the years 1947 through 1957, whereas total population in 1954 was 9 million. An analysis of the occupational distribution and employment status of the immigrants appears in an article entitled "Employment of Post-War Immigrants in Australia." [44] This analysis was made possible by the records of the International Refugee Organisation, statements by immigrants on admission, and occupational data from censuses of 1947 and 1954. Such rich sources of information will not be available in most countries. To the extent that data of this kind are available, they constitute a basis for arriving at some reasonable assumption regarding the occupational characteristics of future immigrants.

The Potential Supply of Workers to Each Occupational Category

A summary of the estimates of the various categories for each occupation will provide an estimate of the future supply. For example the following tabulation provides an estimate of qualified workers in Occupation X in 1970. This estimate includes an unknown number of qualified workers who will not be available for employment at any given time.

The 1960 pool of qualified workers in Occupation X.

Currently employed...........	2,500
Estimate of qualified workers not currently employed.....	100
	2,600
Outflows 1960-70:	
Deaths and retirements.....	225
Transfers out..............	100
Emigration, including foreign nationals........	25
	- 350
Inflows 1960-70:	
Completion of formal training at home	
Those now in training....	200
Future entrants to training...............	350
Completion of training abroad....................	30
Without formal training....	120
Transfers in...............	350
Immigration................	---
	+ 1,050
Estimate of 1970 supply in Occupation X	3,300

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[44] W. D. Barrie, and Mr. J. Zubrzyski. "Employment of Post-War Immigrants in Australia," *International Labour Review*, March 1958, pp. 239-253. For a discussion of Canada's postwar immigration see: David C. Corbett, "Immigrants and Canada's Economic Expansion," *International Labour Review*, January 1958, pp. 19-37.

Balancing Requirements With Supply

The estimates of employment by occupation group as derived in Step 4 may be considered as requirements or demand for each category. The estimated supply as derived for each occupational category in Step 5 can be compared with the demand to provide an indication of the anticipated shortage or surplus in each category. This information may point the way to adjustment needed in the educational system and in the training activities of industry and government.

Despite the limitations of the available data, and the uncertainties of the assumptions and judgments utilized in making such a study, the conclusions reached should contribute valuable insights into the training needs as related to the future development of the country.

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Appendix

International Standard Industrial Classification of All Economic Activities

List of Divisions and Major Groups

Major Group	Division 0. Agriculture, Forestry, Hunting and Fishing
01	Agriculture
02	Forestry and logging
03	Hunting, trapping and game propagation
04	Fishing

Major Group	Division 1. Mining and Quarrying
11	Coal mining
12	Metal mining
13	Crude petroleum and natural gas
14	Stone quarrying, clay and sand pits
19	Other non-metallic mining and quarrying

Major Group	Divisions 2-3. Manufacturing
20	Food manufacturing industries, except beverage industries
21	Beverage industries
22	Tobacco manufactures
23	Manufacture of textiles
24	Manufacture of footwear, other wearing apparel and made-up textile goods
25	Manufactures of wood and cork, except manufacture of furniture
26	Manufacture of furniture and fixtures
27	Manufacture of paper and paper products
28	Printing, publishing and allied industries

Major Group	Divisions 2-3. Manufacturing--Continued
29	Manufacture of leather and leather and fur products, except footwear and other wearing apparel
30	Manufacture of rubber products
31	Manufacture of chemicals and chemical products
32	Manufacture of products of petroleum and coal
33	Manufacture of non-metallic mineral products, except products of petroleum and coal
34	Basic metal industries
35	Manufacture of metal products, except machinery and transport equipment
36	Manufacture of machinery, except electrical machinery
37	Manufacture of electrical machinery, apparatus, appliances and supplies
38	Manufacture of transport equipment
39	Miscellaneous manufacturing industries

Major Group	Division 4. Construction
40	Construction

Major Group	Division 5. Electricity, Gas, Water and Sanitary Services
51	Electricity, gas and steam
52	Water and sanitary services

List of Divisions and Major Groups--Continued

Major Group	Division 6. Commerce
61	Wholesale and retail trade
62	Banks and other financial institutions
63	Insurance
64	Real Estate
	Division 7. Transport, Storage, and Communication
71	Transport
72	Storage and warehousing
73	Communication

Major Group	Division 8. Services
81	Government services
82	Community services
83	Business services
84	Recreation services
85	Personal services
	Division 9. Activities not adequately described
90	Activities not adequately described

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